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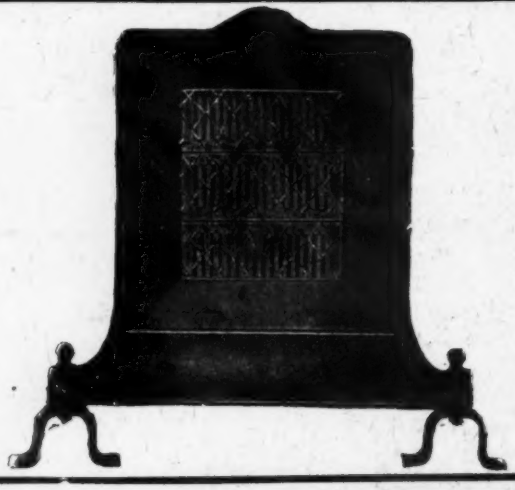

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THE

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VOL. XC. MAY 19, 1922. No. 2,321.

ELECTRICAL REVIEW.

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THE INDUSTRIAL COURT'S REPORT ON THE LOCK-OUT.

WE summarise on another page the introductory portion of the Report and the conclusions of the Court of Inquiry which has investigated the engineering trades dispute, and we regret that it has not been possible to reproduce the report in full. It is an interesting and exhaustive document, and the description of the course of events relating to the various agreements which have from time to time subsisted between the employers and the workpeople has considerable value as a concise and clear historical document. The Report is published by H.M. Stationery Office at the price of 6d., and it should be purchased and studied by all who are interested in the working of the industrial machine—and this includes, or ought to include, everyone whose bread-and-butter depends on the maintenance of prosperity in British engineering.

It is apparent that the Overtime Agreement of September, 1920, was not three months old when trouble began to arise over the interpretation of the words "when overtime is necessary." Sir William Mackenzie, K.C., who, as our readers are aware, was the Court of Inquiry in the present instance, shows in his report that, by custom, the decision as to when overtime was necessary was made by the employer, who is, in his words, "the person most competent to decide this question of urgency in any particular case." We are naturally glad to find that the views we have expressed on this question are upheld, for it was clear at the beginning that, as the employers and the members of the A.E.U. Executive had, after prolonged discussion, agreed, the interference with managerial functions that had grown up during the last few years had become intolerable, and was a serious hindrance to business. The contention of Mr. Peter Dickinson, a member of the A.E.U. Executive, who gave evidence, was this: "When the workmen want changes in workshop conditions they have to make application, and there has to be consultation and conference. We think the same rule should apply to the employers, and not that they should be able to do just as they like without consultation." The only other witness who appeared, Mr. W. H. Hutchinson, was asked by Sir William Mackenzie what he thought should be done instead of letting the instructions of the management be observed pending the discussion of any question in connection therewith. His reply was: "I think the whole thing should be held up."

No doubt these views come naturally to those who see only one side of the question. We would have expected them to be brought forward and to be pressed for all, and more than, they were worth at the discussion out of which the memorandum of November, 1921, was evolved. We remember that it was stated in one of the manifestoes issued by the A.E.U. that it was only after sixteen hours' discussion that their executive agreed to recommend the acceptance of that memorandum by their members. Such pertinacity in the presentation of the point of view is entirely reasonable, within limits. It was praiseworthy up to the point of the acceptance of the memorandum. It is disappointing, however, to find that after persons have apparently accepted, as the result of protracted discussion, another point of view than that with which they started, they should fall back on the old one at a later date. The man who never changes his mind is an impossible person; probably James II was one of the most notorious examples in history of this type of individual. The man who changes with every

wind that blows, whose opinion is ever that of the last person who was with him, is equally impossible; and probably history will write down the late Tsar Nicholas as belonging to this variety. We know all about the woman convinced against her will, but we are entitled to expect from reasonable men that they shall, when they have renounced an unsound view, and adopted one which they consider sounder, remain of the same opinion until some material change of circumstances shall occur and thereby warrant a further modification. The probability is that the A.E.U. Executive were rebuked by the more extreme element, and were told that their business was, not to be reasonable, but to stick up for the rights of prior consultation and prior consent. Surely it must be clear that it is not possible that "the whole thing should be held up" while negotiations which may take anything up to six weeks are carried through. Examples must be within the knowledge of all our readers, of work which has been placed in other countries because customers have felt that British labour conditions were not sufficiently stable to allow of reliance upon promised delivery dates. Dependability in this, as in other, respects has been the mainstay of British business in the past. We are accustomed to repeat, with justifiable pride, that an Englishman's word is his bond, and now that the practical abandonment of the contract price adjustment clause has largely restored the financial truth of this boast, it becomes necessary to see that it is invulnerable from other directions also.

All agreements of the kinds dealt with here, as well as those between manufacturers covering the sale of their goods, must necessarily suffer from a degree of looseness of phraseology which would not be tolerated in documents dealing with definite legal transactions. A document of the kind sometimes called a "gentleman's agreement" is meant to be honoured rather in the spirit than in the letter. Sir William Mackenzie, in clause 31 of the Report, says: "Experience of the working of these agreements appears to confirm what a perusal of them suggests: that they do great credit to the ingenuity and good sense of the parties and afford a safeguard against the nurturing and continuance of grievances or difficulties which, if not ventilated, would have grave consequences." However, it cannot be regarded as surprising that the employers came, in the present instance, to the conclusion that it was necessary to clear the air, for a good deal of fog has accumulated around shop customs and practices, and there appears to be a tendency to regard what has been done within four particular walls as something approaching in inflexibility a law of the Medes and Persians. It would be absurd to have to remove the manufacture of some piece of apparatus from one works to another, possibly under the control of the same company, for the sole reason that shop customs or wages which had been established in the one situation, were unprofitable and were not susceptible of variation while the manufacture continued to be carried on in that situation. This seems to presuppose a degree of immutability in earthly affairs of which the physical universe affords no evidence. The necessity for the introduction of new processes, of new machinery and methods, must be a matter for the judgment of the employers, simply because, if it were not so, business would disappear, and with it, employment. Sir William Mackenzie puts it as well as it can be put when he says that "means should be devised whereby skilled men displaced as the result of introducing new methods or processes may be rapidly absorbed in work suitable to their qualifications." He does not entertain any fear "that the scope of employment will become restricted or that, in the industry as a whole, skill and good workmanship will become superabundant." This is absolutely in accordance with the experience of all who have been concerned in electrical and engineering manufacture in this country. The object in view must not be merely the completion of a certain *quota* of business or trade in the cheapest manner possible, but the general expansion and improvement of business as a whole, and the consequent advancement of the sum total of human happiness.

The representatives of the employers and of the unions, including the A.E.U., met together on Tuesday last. *The Observer* of Sunday held the view that currents of opinion were at work which led some of the most influential employers to express forcible dissatisfaction with the "intransigeance" of their Federation.

According to the *Daily Telegraph*, the number of employers attending on Tuesday seemed to be larger than had been customary in the previous negotiations. Conversations regarding procedure and the November Memorandum having taken place, the employers proposed to submit definite proposals for the consideration of the Unions on Wednesday. The *Telegraph* added:—"While the employers' proposals will maintain intact the principle of their right to manage their works—a right which the trade unions say they do not in any way challenge—it is hoped that such a modification of the machinery for avoiding disputes may be arranged as will secure the right to the exercise of managerial functions in a form which will prepare the way for a settlement of the dispute. There is a recognition on the part of the employers that in cases where the introduction of improved machinery displaces skilled craftsmen for semi-skilled or unskilled men, any hardship should so far as possible be mitigated by finding other work for the skilled men who have been displaced."

"Simplification."

In the Trade Supplement of *The Times* under date April 29th appeared the first of a series of articles on "Simplification in the United States," by Mr. Cecil Chisholm. It seems that simplification in industry is having a good run in the States just now, one of its main objects being to bring down the cost of production and thereby to restore a general prosperity in trade. Conferences appear to have been held under the auspices of the Department of Commerce at Washington, and an instance is quoted in connection with the American paving brick industry. Mr. Hoover presided at this conference, the result of which was that the varieties of paving brick to be manufactured in future were reduced in number from 66 to 20.

Other trades are being tackled in a similar fashion, with the result that standardisation and reduction of types are being secured by general agreement.

The work seems to be somewhat similar to that done by the Engineering Standards Association on this side in connection with steel sections, steel rails, and many other items.

The American Committee appears to have been chiefly the outcome of the war, the War Industries Board having effected very important savings when the supply of materials was unequal to the demand.

In our view nothing can exceed the importance, especially in the engineering trade, of standardisation, and we only wish that it were possible to commence in the electrical industry by adopting a standard voltage for the whole country. The advantages which might have been secured by the pursuit of such a policy from the beginning are so colossal that if this method had been adopted the use of electricity would probably have been by this time wellnigh universal. The idea of endeavouring to retrace our steps has for the present been suspended or at least postponed until better times enable us to bear the sacrifices involved. In the meantime, unfortunately, every development of the various undertakings leads us further and further from the ideal.

It is not only in the direction of standardisation in manufacture, but in almost every relation of life that simplification is required. A simplified currency would be quite an easy matter and would assist foreign Powers in placing their orders with us almost as much as a good reduction in prices. Simplified systems for postal and telephone charges would be equally beneficial to the busi-

ness world, while a simplification of legal methods and procedure is one of our greatest necessities. Patents and designs, railway rates and freights might all be the subject of enormous improvement, with a minimum of expenditure, and a simplification of taxation in general would be almost as valuable as another 1s. off the income tax. Unfortunately the tendency of the time is towards over-organisation, complication and variation, and we fear that this will be so as long as the legal mind manages to retain the preponderating influence in all the affairs of the nation.

Workmen's Compensation.

At the end of the year the War Additions Acts, which provide for an increase in compensation, will expire, and Parliament has recently discussed the amendments in the Workmen's Compensation Act, 1906. A year or two ago a Committee appointed by the House of Commons considered the matter, and came to the conclusion that the law should be reviewed, as when the subject was introduced in 1897 it was entirely novel, whilst to-day workmen's compensation is part of the law in every civilised State and in every other country is more in favour of the workman and more advanced than it is in this country. The Committee was strongly of opinion that benefits should be more generous to the workman in case of injury and more generous to the family in case of fatal accident. The Committee was fully satisfied that the increased scale of benefit would not materially increase the cost of production, as in the most expensive industries it would not exceed 1d., and in the majority of industries would be not more than a fraction of 1d. in every £1 charged to production.

It was asserted that the tendency was for accidents to increase, and that every year 500,000 workers were killed or injured, of whom or in respect of whom 430,000 were compensated, and that 14,000,000 working days were lost in consequence of such accidents.

On behalf of the Government the House was asked to accept a motion which had been moved calling for a Government Bill, and it was stated that whilst there was a great deal to be said for compulsory insurance or State insurance there was no unanimity of opinion, and the Government could not be pledged to any detail of reform. The main thing was, in the first place, to prevent accident, and in the second to adopt the best means to secure recovery, the question being a national one having no reference to party.

It was suggested that a joint committee of employers and workers should consider the recommendation of the Committee so as to find a basis for a scheme to be introduced to the House in the hope that a round-table conference would shortly be held which would enable the Government to introduce and carry during the present Session a really effective and useful measure.

The Japanese Electrical Industry.

According to the official *Journal* of the Yokohama Chamber of Commerce, the Electricity Bureau of the Japanese Department of Communications records a remarkable development in the electrical industry in that country. During the ten months ended with October, 1921, a further sum of 166,000,000 yen was invested in electrical undertakings. At the end of that month there were 728 works supplying power, 52 electric tramways and railways, and 50 other combined supply and traction undertakings, making a total of 830. Although this total shows a decrease of four undertakings as compared with the number existing at the end of 1920, the explanation lies in the circumstance that certain works have absorbed others. In the course of a statement issued at the beginning of the year, the Minister of Communications is reported to have remarked that his policy was to accelerate the formation of combinations. The electrical industry, he said, occupied the most prominent position of all the industries in Japan; it had attracted an aggregate capital of 1,600,000,000 yen, while the productive capacity of the plant amounted to 1,340,000 kW. One of the primary conditions for the further development of the industry was the combination and systematisation of the undertakings. Though an increasing number of consolidation schemes were being reported, the Minister stated that it was necessary to give a greater impetus to this tendency among the electrical undertakings, and at the same time he urged that electrical engineers should attain the primary object in view of those favouring combination by the readjustment of power transmission systems or management of plant, thereby raising the efficiency of the plant so as to promote the power-consuming industries, upon which the economic life of Japan depended. In conclusion, the Minister referred to the electrical manufacturing industry, the development of which, he said, largely depended upon the industry itself. Improved machinery was required in connection with the progress of lighting and power undertakings, but the Japanese electrical construction works were not yet able to produce plant which could bear comparison with good foreign machinery.

High-speed Wireless Telegraphy.

In the I.E.E. paper, of which we give an abstract to-day, Lieut.-Col. A. G. T. Cusins refers to the fact that the ether is in danger of being overcrowded. Whilst the policy of the Post Office in restricting the installation of transmitting sets in this country has prevented the plague of promiscuous signalling which has been experienced in the United States, it appears that even the commercial and official wireless stations of Europe are beginning to suffer from mutual interference, although they have the range of wavelengths between 50 and 50,000 metres to work in. No doubt the selective properties of receiving apparatus will be further improved as time goes on, and will alleviate the situation. In the meantime, attention is being directed to high-speed transmission, which shortens the period during which the ether is occupied, and is found to afford considerable relief in respect of atmospheric disturbances; the possibilities of directional control are also being investigated.

Great credit is due to the work accomplished by the Royal Engineers both during the war and since the Armistice. At the same time, it should not be forgotten that high-speed wireless, up to a point, was done before the war. In September, 1912, Marconi's Wireless Telegraph Co., Ltd., gave a demonstration of its working at their Chelmsford works to representatives of Government departments, recording on a tape signals transmitted from Poldhu. Further demonstrations were given by the company at Clifden in January, 1914, when speeds of 100 and 145 words per minute were attained, and again between Chelmsford and Galway in May, 1914. The Postmaster-General of that day proposed to adopt the system between Stonehaven and Newcastle-on-Tyne as a stand-by to the overland wires. These facts were recorded in our pages at the time. The war, of course, delayed further developments.

Lead-covered Wires.

The article by Mr. P. Dunsheath, which appears elsewhere in this issue, recalls the lengthy correspondence which took place in our pages some months ago on the durability of lead-covered wires. As the author points out, lead is one of the most durable of the base metals, under normal conditions, but like Achilles, it has one vulnerable spot—its affinity for certain organic acids.

However, it will be seen that the Lynton case was altogther exceptional; the wire was carried through the cores of oak beams, where the conditions were to a unique degree favourable to corrosion, and even then the cable lasted over 20 years. Under ordinary circumstances, therefore, with the exercise of common sense, and sound workmanship, there is no reason to anticipate that any trouble will arise from the use of lead-covered wire, even in contact with oak.

D

SUBMARINE DIESEL ENGINES AT SOUTHEND.

When the Germans built and equipped their submarines, we may be sure that no pains were spared to make them reliable, safe, and efficient, and as the motive power was the principal consideration there can be no doubt that the engines installed were of a high order. It is therefore satisfactory to know that when the undersea craft were surrendered to the Allies not all of these engines were dismantled and scrapped. Many of them were adapted to peace purposes, after having been used for purposes the reverse of peaceful. Consequently in two or three electricity undertakings in England these Diesel engines may now be found, and one of these undertakings is at Southend-on-Sea.

The official inauguration of the converted Diesel plant took place on April 27th, when the Mayor and Council, accompanied by contractors' representatives and others, made a tour of the electricity undertaking of the county borough, which comprises four sets of plant contained in a main station at London Road, sub-generating stations at Leigh and Thorpe Bay, and a battery sub-station in Chalkwell Park.

For a considerable time controversy has raged round the comparative advantages of steam and oil, and also in connection with centralisation of plant as compared with small stations at several places. As regards the first point, the contentions of the borough electrical engineer (Mr. Robert Birkett, M.I.E.E.) in favour of oil engines would appear to be justified. Southend is as far away from the coalfields as almost any district in the country, so that the cost of coal is considerably heightened by transport charges; although in this respect it should be said that the town is conveniently situated for the handling of water-borne coal. This enhanced cost has forced the Corporation Electricity Department to purchase inferior grades of coal in an endeavour to balance accounts at the expense of efficiency. Another serious impediment to the employment of steam plant is the deleterious effect which the local water has upon boiler tubes and condensers. The Corporation has had to install a special water-treatment plant, owing to this, and it is stated that the ultimate cost of water is over four shillings per thousand gallons!

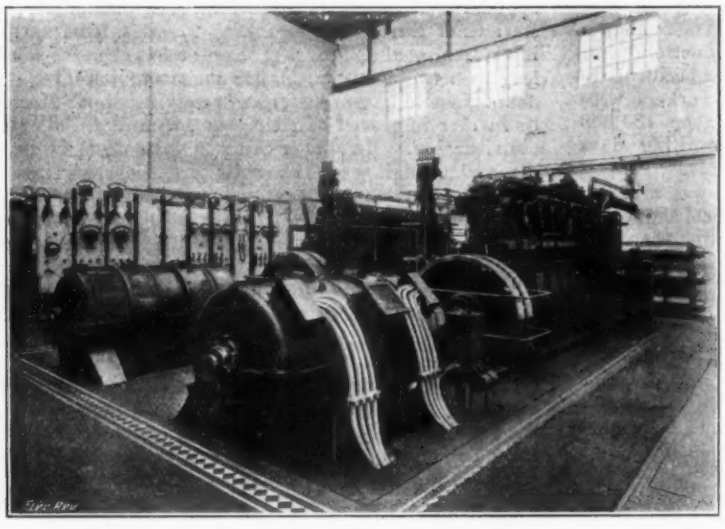


Fig. 1.—The Thorpe Bay Sub-station.

At various times the erection of a large steam station at one of three sites has been advocated, the alternative suggestion being the installation of Diesel engines at two or three suitable points. The present steam station at London Road is unable to deal efficiently with the demand in outlying districts. The plant produces direct current at 460-500 V, and it will be seen that the transmission losses in feeders to districts four miles or more away would be considerable. Therefore, the only alternative to the installation of a.c. plant at the London Road station or boosting plant elsewhere was the scheme adopted, viz., the erection of two sub-generating stations equipped with oil engines. In the early days of the European war an order was placed with Messrs. Belliss & Morcom, Ltd., for three six-cylinder Diesel engines direct-coupled to 200-kW d.c. generators. These were completed but never delivered to the town; at the request of the Government the Corporation allowed them to be diverted for war purposes. The position of the undertaking after the war was acute, new plant being urgently required. At the suggestion of the engineer, it was decided to secure the engines of surrendered German submarines and have them re-conditioned and adapted to land use by Messrs. Belliss & Morcom, Ltd. This was carried out, and the plant is now available for supplying the urgent demand for power.

The Thorpe Bay station was the first to be visited by the party. Here two 550-b.h.p. Diesels, taken from the UB 149, have been installed with their original generators capable of an output of from 270 to 300 kW each. A marble switchboard has been erected and fitted by the Electric Construction Co., Ltd. Thorpe Bay is a growing residential district between Southend and Shoeburyness, and appears to present a likely field for electrical development. The next part of the itinerary was a visit to the Chalkwell Park battery station, in which are housed 268 Chloride cells with a capacity of 4,000 Ah, together with a Lancashire Dynamo Co. booster. The switching here is arranged for either direct control or for "remote" operation from the London Road station. At Leigh, where the visitors were regaled with tea, there are two large Diesel sets, consisting of 1,200 (nominal) h.p. six-cylinder engines, from the submarine U 164, driving 500-kW generators. The Leigh sub-station was specially erected to accommodate the three 200-kW sets ordered from Messrs. Belliss & Morcom, and only about half of the building is taken up by the German plant. The party was introduced to Mr. W. Sharpe, who is in charge of the Diesel plant. This gentleman was placed in charge of the first captured submarine, and has a thorough knowledge of the machinery.

The inspection concluded at the London Road station, where there are installed four Belliss & Morcom three-crank, triple-expansion steam engines, one coupled to a B.T.-H. generator and the rest to Crompton generators, each of 500-kW capacity; one Howden triple-expansion engine driving an E.C.C. generator; and two more submarine Diesel sets. The last are similar to those at the Leigh sub-station, the generators being capable of an output of from 500 to 540 kW. They were taken from the U 100. The steam generating plant at this station has recently been extended by the addition of a new Ledward & Beckett evaporative condenser capable of dealing with 60,000 lb. of steam per hour, a Niclausse boiler of 30,000 lb. capacity, an induced-draught plant, and an ash-conveyor and elevator.

It is claimed that the Southend Diesel engine installation is the largest of its kind in this country. The nominal output is 5,900 b.h.p., but this has been rated down to 4,000 b.h.p. or 2,500 kW. The generating costs, it is stated, are only half of those of the steam

plant, and, as mentioned before, there is a marked diminution in transmission losses.

The construction of the generators is worthy of special mention. Each unit consists of two d.c. generators totally enclosed by a common casing. They have one bearing per armature and, therefore, two per set, thus allowing the armature to be rotated independently of the engine, if desired. Those at London Road station were constructed by Siemens-Schuckert in 1916, the continuous rating for each armature under generating conditions being 1,000 A at 270 V, giving 270 kW at 450 r.p.m. Under motoring conditions (*i.e.*, when propelling the submarine) the continuous rating was 1,000 A at 220 V, giving 199 kW at 267 r.p.m. For one hour the rating is 210 V, 1,160 A, or 220 kW at 338 r.p.m.

The two generators are externally connected in series, making the whole a 540-kW unit. The machine has ten main poles, interpoles, and a special compensating winding. Should a fault develop on either of the interpoles or compensating winding, both can be immediately cut out by means of the main terminal connections, and the machine can be run as a "shunt." An interesting feature of the compensating winding is that it consists of single copper conductors $\frac{3}{8}$ in. by $1\frac{1}{2}$ in., passing through slots situated under the main poles and parallel to the armature conductors. As the conductors of this winding are entirely separate, they are connected in series by means of heavily-enamelled copper back and front connections, giving the whole the appearance of an a.c. chain-wound stator. By removing the inspection door access is given to the brush gear and its respective flexible connections. On disconnecting these the rocker can be rotated and any particular brush arm can be inspected. These arms are made of mild steel fitted with copper oxidised spring steel brush boxes, fastened to the spindle with cast-iron clamps. The existence of so much iron and steel on this brush gear suggests that the Germans were rather short of brass during the war. There are ten brushes per arm, giving a total of one hundred per commutator, the dimensions of the brush being 2 in. long, 11/16 in. wide, and 9/16 in. thick.

The armatures are considerably smaller than those of the usual 500-kW, 1,000-A, land-type machines. The great increase of output for a given size is accomplished by the use of forced draught fans (independently driven at 2,000 r.p.m.) forcing air through the ventilating ducts and thus to the windings. In the event of the stoppage of the fans, the temperature of the windings would rise very rapidly beyond the safe limit. Without the fans and with inspection doors removed half load can be obtained with safety. This dependency of the main unit upon a small auxiliary is naturally a disadvantage.

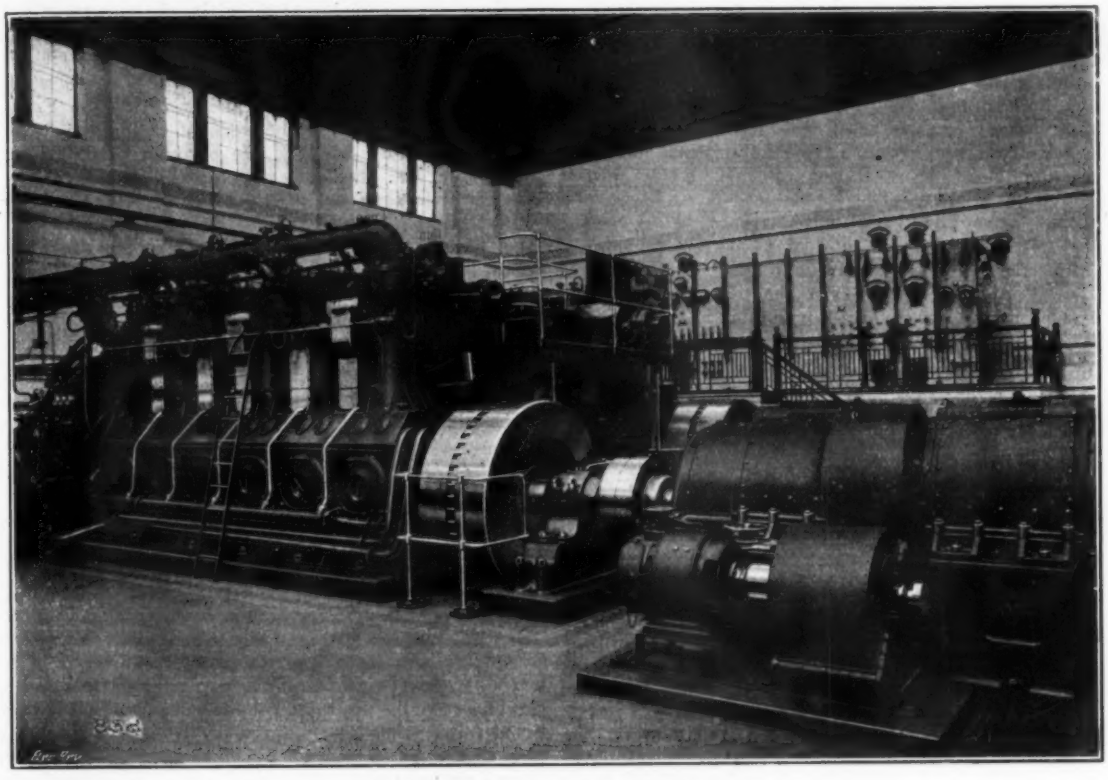


Fig. 2.—The Leigh Sub-station.

The two sets at Leigh were also made by Siemens-Schuckert and are dated 1918, being rated as 540-kW generators. They differ from those at London Road in respect of the construction of the field system. They have no compensating windings and possess smaller brushes for the same output. The field system is of the revolving type connected to the main yoke by a heavy oil dash-pot. The dash-pot come into action under motoring conditions when heavy starting currents were required. By releasing the dash-pot the field system

Fig. 3.—Exterior of Leigh Sub-station.

can be rotated, enabling any field coil or interpole to be removed without disconnecting the main yoke or removing the armature.

The Thorpe Bay generators were made by the A.E.G. of Berlin (1918), and have a continuous rated output of 600 A at 310 V and 450 r.p.m. As the armatures are connected in series, an output of 600 A at 620 V, or 372 kW, can be obtained. There are eight main poles without a compound winding, and the interpoles can be quickly disconnected by the main terminal connections. In this case also the field system revolves, if necessary, and therefore has similar advantages to those at Leigh. The field current of these dynamos is extremely high compared with the field current of those at London Road; in the total I²R loss field coils at full excitation is approximately 20,450 watts. Those at London Road have a loss of only 7,469 watts for a greater output. The brush gear is made up of mild steel arms and brass boxes, there being three brushes per arm, giving a total of 24 per commutator. The dimensions of the brush are 2 in. long, 1½ in. wide, and 39/64 in. thick. Here also the maximum output is obtained by the use of forced draught fans.

On all these sets it has been found necessary to undercut the commutator mica. With a fixed brush position and within the range of the generators, all sets carry any load with perfect commutation leaving little to be desired.

Fig. 1 is a view of the Thorpe Bay installation from the generator end. The engines are seen more clearly in fig. 2, which illustrates the Leigh sub-station. It will be seen that ample space has been provided in each case, and that the buildings are well lighted and ventilated. Fig. 3 is an exterior view of the Leigh building.

Upon the conclusion of the visit, the party was entertained at "supper" by Councillor G. Radford, the Chairman of the Light Railways and Electric Light Committee. In proposing the toast of "The Electricity Undertaking," the Mayor (Alderman Sir John Francis, J.P.) paid a tribute to the work of Councillor Radford and Mr. Robert Birkett, the borough electrical engineer, and Mr. Radford responded. In the course of his reply to the toast of "The Electrical Engineer," Mr. Birkett outlined the history of the undertaking, and stated the reasons for his preference for Diesel plant. He gave some examples of the reliability and longevity of these engines, mentioning that in Germany many had been running practically continuously for 14 or 15 years. With Diesel engines a thermal efficiency of from 25 to 30 per cent. could be obtained.

THE CORROSION OF LEAD-COVERED WIRING BY OAK.

By P. DUNSHEATH, M.A., B.Sc.,
Chief of Research, W. T. Henley's Telegraph Works Co., Ltd.

An unusual case of the corrosion of lead-covered wiring was recently brought to light by Mr. P. T. Kimmins, manager of the Lynton and Lynmouth Electric Light Co.* In carrying out the rewiring of the Lynton Town Hall, which is famous for its fine oak work, the existing wiring was found to be very badly corroded in places and, as a matter of interest, Mr. Kimmins sent several short pieces of the recovered cable to the Electrical Review office. By the courtesy of this gentleman and of the Editors we have been able to make an examination of the samples, and have detected one or two points of sufficient interest to justify a few notes on the effect of oak on lead.

The cable, which was 7/.029 v.i.r. lead-covered, was erected in 1900. Some of the wiring was carried out on beams of Stettin oak, and in places had been drawn through holes bored in the beams. Where the lead covering was not in contact with the oak there was no corrosion, but where it passed through the beams, corrosion had taken place to a serious extent. Fig. 1 shows the general appearance of two of the worst portions. The entire surface is coated with a white crust, varying in thickness up to more than one-sixteenth of an inch, which, on analysis, proves to be the basic carbonate of lead (white lead), and in places there is very little of the original sheathing left. The deposit has been examined for traces of substances likely to cause corrosion. Foreign matters, such as nitrates and chlorides, cannot be detected, and the carbonate is slightly acid; but, although the acid is found to be organic, it is not present in sufficient quantity to be identified.

In considering the features of this case, it is of interest to note a few general considerations on the use of lead work in proximity to oak. For many years it has been recognised by architects and builders that lead should not be fixed in contact with green oak. Care is taken in museums not to store objects made of lead in oak cabinets, although mahogany and other woods are quite safe. The lead linings in old oak coffins are said to be converted to a white earthy mass of the basic carbonate, and, in erecting sulphuric acid chambers in chemical works, care is taken to keep oak away from the lead.

A few years ago particulars were published† of two cases of failure of lead roofing due to the action of oak. In one case the lead sheet had lain in contact with a wood foundation for an unknown period—the building was two hundred years old—and, when taken up, was found to have a thick white crust of lead carbonate. Some of the beams were oak and some pine, but only those parts in contact with the oak showed the corrosion. In the second case, the lead had only been renewed nine years, yet in one part seven pounds of lead had been destroyed per square yard, while at another part of the same building, which was a church, lead laid in 1833 was found to be still in good condition.

A correspondent of the *Builders' Journal* some years ago‡ described a case where the lead glazing of windows in a billiard room was corroded with the formation of a white powdery substance. In this case the walls of the room were almost completely covered with oak panelling, and the ceiling had exposed oak joists and beams.

It is fairly well known that the cause of the corrosion of lead in contact with oak is the presence of organic acids in the latter. The chemical action which takes place is best illustrated by the commercial method of manufacturing white lead. Strips of lead are hung in a chamber containing acetic acid vapour and moist carbon dioxide. Although the chemical changes which take place are somewhat complicated, they can be outlined as follows: The oxidation of the lead in the moist air first produces the hydroxide $Pb(OH)_2$, which reacts with the acetic acid $CH_3 CO.OH$, forming lead acetate $Pb(C_2H_3O_2)_2$. In the absence of carbon dioxide the chemical change would probably cease at this stage; but, with CO_2 present, the lead acetate is converted into the basic lead carbonate $2\,Pb\,CO_3Pb(OH)_2$, and the acid is partially regenerated for further action. In this way a small quantity of acetic acid can effect the corrosion of a large quantity of lead, as it may be used over and over again.

Among the organic acids found in oak are acetic and

*See Electrical Review, Vol. 89, p. 817, 1921.

†*Journal* Society of Chemical Industry, Vol. 37, p. 39r, 1918.

‡*Builders' Journal*, Vol. 24, p. 149, 1906.

tannic, and it is by no means certain which is responsible for the corrosion of lead, although the action would probably be very much the same in either case. With tannic acid the intermediate product, instead of the acetate, would be lead tannate, but the final product would be the same—the carbonate.

It is useful to connect some of the factors in the corrosion process with the various examples quoted. In the Lynton case the corrosion was most noticeable where the cable ran through holes in the beams. At these points, due to absence of ventilation, the air surrounding the cable would be charged with the acid vapours from the wood; and temperature rise, due to current, would no doubt accelerate the chemical action. In the lead roofing cases there would be no ventilation under the lead sheet and the acid vapour would tend to become concentrated. Variation between one part and another of the same roof might easily be caused by temperature differences due to one part being subjected to the rays of the sun and another part being always shaded. In the panelled library case, with such a large surface of oak—particularly if it were not well seasoned—the air in this room would become charged with the acid vapour which would tend to condense, along with moisture, on the cold window frames, so supplying the corroding influence just where required. This particular action would not be likely to occur on a lead-covered cable in the same room as the relatively low temperature condition, so necessary for the condensation of the acid vapour in an open space, would not hold. The important factor, then, common to all cases, seems to be that of the ventilation in the immediate vicinity of the lead.

Detailed examination of the Lynton samples under a microscope revealed one or two unusual points of interest. Sections of the cable, plus the corrosion product, were cut, mounted in wax, and polished. Fig. 2 shows a complete section magnified five diameters, while fig. 3 shows a small part of the carbonate alone magnified twenty diameters.*

It will be seen from fig. 2 that the lead carbonate is built up from the surface of the cable with a columnar structure, each column being not sector shaped, but having the same width at the top and bottom. This, of course, would be expected from considerations of the action involved. The corrosion takes place at the surface of the lead, and the new product raises the layers already formed, so building the columns by adding to the material at the base.

The most interesting feature, however, was noticed under the higher magnification. As will be seen from fig. 3, annular rings similar to those found in the sections of trees are clearly defined. The number cannot be counted with any precision, owing to the absence of definition near the outer skin; but it appears to approximate to the number of years the cable has been installed. Still higher magnification, which was only employed visually, showed that the lines seen in the photograph were made up of a large number of finer lines, and that the former are really due to the periodic crowding together of the latter.

One is very tempted to theorise on this peculiar formation and on other minor observations of the structure noted in the examination; but, whether the rings be due to the peculiarities of colloidal diffusion, or variations in temperature, humidity, or CO_2 content, a good deal of experimental work would be required to arrive at any satisfactory conclusion.

In view of the recent discussion which has taken place on the relative merits of lead-covered and other systems of wiring, it is important that a case like the Lynton one should be given publicity. A case of corrosion here and there, which may be quite easily explained when investigated, is liable, in the absence of full inquiry, to create an entirely erroneous impression and may be used as a basis for destructive criticism as prejudiced as ungrounded. In rubber we have a wonderfully convenient insulating material; but, from its very nature, the life of a rubber-insulated cable is very closely related to the efficiency of the protection afforded it against the well-known destructive effects of air, light, and moisture. The use of a lead covering provides a remarkably good solution of this problem. For convenience of handling, on account of its ductility, a lead sheath has no rival. It is absolutely impervious to air, light, and moisture, will not rust, and, in the absence of certain well-known and easily-avoided destructive agencies, has remarkable endurance. In spite of a certain amount of loose talking on the subject of corrosion, a lead-covered rubber-insulated wire does make a sound mechanical and electrical job. Certainly it requires the exercise of common sense and judgment in use. To run a lead cable through an oak beam, where a plumber would decline to lay a waterpipe, is asking for trouble, but there is no reason why the intelligence should all rest with the plumber. Our own experience, as the result of experiments and observation, has been that, if the position is well ventilated, corrosion of lead in contact with well-seasoned oak is very slight indeed. We have met cases where, after many years, the effect even in a confined space has only amounted to the merest film on the surface of the lead, but obviously a beam of heavy section, even if well seasoned, must still contain organic acids in the interior, and, considering the circumstances under which it was erected, the Lynton cable did well to last as long as 21 years.

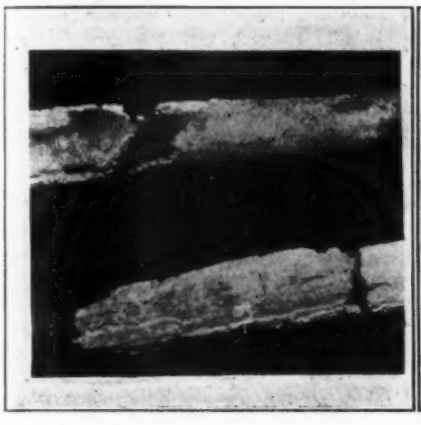


Fig. 1.—Samples of Corroded Cable.

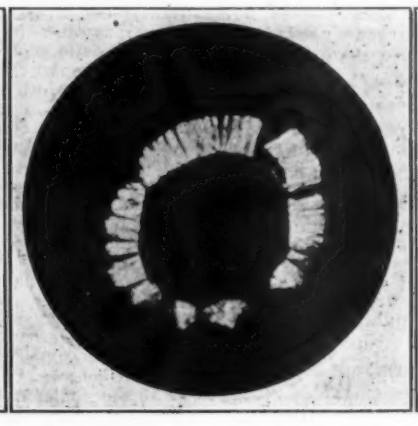


Fig. 2.—Section of Corroded Cable (Magnified 4 Diameters).

Fig. 3.—Sample of Lead Carbonate (Magnified 16 Diameters).

* The illustrations are four-fifths of the size of the original photographs.—Eds.

A "Leader" Cable for Aeroplanes.—An experiment with an electric cable for the guidance of aeroplanes is to be commenced at Brussels in the course of a few days. In France the reports of the experts and a sub-committee are awaited before commencing experiments.—*Westminster Gazette.*

A CALL TO THE ELECTRICAL CONTRACTOR.

By A. E. PERKINS.

That a wide field of opportunity exists for the electric supply undertaking and the contractor, at the present time, few will gainsay.

Not only is the field vast from the standpoint of securing new business, but when one considers that, from the ordinary house-building contract, the electrical contractor is only taking a matter of 2.4 per cent. of the total labour costs, the figure gives food for thought, alongside that of the plumber, for instance, who takes 4 per cent.

The writer has been struck, in looking over and analysing a number of building bills of quantities, costs, &c., to find the different trades work out on the average as under:—

	Percentage of cost. Labour only.
Bricklayers	32.5
Carpenters	24.0
Plasterers	17.0
Painters	7.1
Plumbers	4.0
Electricians	2.4
All others	13.0
	100.0 per cent.

It would appear from the foregoing that the electrical contractor is not taking anything like his share of new work that is going, and there is urgent need for a vigorous educational campaign amongst the public.

"Cleanliness is next to godliness," and good plumbers' work and sanitation is a *sine quâ non* in the modern house, but surely, in these days of labour-saving devices and servantless houses, there is ample opportunity for the electrical contractor to take a higher percentage than 2.4 of the total labour costs.

These figures are put forward, therefore, in an endeavour to show the rank and file of electricians how wide a field of opportunity they have before them.

The writer ventures to think that if a little less secrecy and mystery were observed, and the public educated in the rudiments as affecting the care, repair of small breakdowns, successful and efficient operation and maintenance of the various electrical items marketed, there would be a real revival in the electrical contractor's business, but when, as so often happens, apparently difficulties are placed in the layman's way, the whole business veiled in a shroud of mystery, is there any wonder that the average householder fights shy of the all-electric house?

RUSSIAN NOTES.

Russia's Electrification Position.—The *Isvestiya* says that, according to the Glavelektro Department, on January 1st this year there were 955 electric stations on Russian territory, with a total output of 410,000 kW, of which stations 621 are in towns and 332 in country places, whilst two are district stations.

Where Russia is Electrifying.—A beginning has been made with the work of electrification of the following governments and districts of the South-East of Russia: Don, Kuban-Black Sea, Stavropol, Ter, Gorsky Republic, Daghestan, Kabardinsk, and the Kabatchevsky-Tchetcher territory. The work is being directed by the district bureau of the Land Department and the technical staff includes 18 engineers and 15 technical experts. The most active work at the moment is being done at certain selected points.

Electricity in Agriculture in Russia.—The peasantry, says an official journal, are expecting considerable help from the Government in the introduction of electricity into agriculture and into village life. It is recommended that the Government should engage in propaganda to popularise electricity amongst the country people, including their education in the simpler forms of application of current. But they must be aided financially, and such aid should be accompanied by the formation of co-operative societies to handle the business. This was provided for when the Elektrozem (country electric council) was instructed to draw up a normal agreement to apply to a co-operative country community for installing electricity and the planning of variants to typical agricultural electric plants. Notwithstanding approved plans, &c., recommended by the Elektrozem for thirty agricultural plants, this number was reduced to a fifth, and further reduction is threatened. Obviously, says the writer quoted in the official journal, "the reduced programme can only be called experimental."

From midsummer the Practical Electrotechnic Institute of Moscow will start a course of instruction in electricity in agriculture.

Russian Electrical Trust Difficulties.—Not long ago a conference was held at the offices of the Glavelektro (chief electrical department) attended by representatives of the electro-industrial trusts and responsible servants of the Glavelektro, at which questions were studied affecting current work, particularly combination in the electrical industry. According to the reports submitted by the representatives of the trust it appeared that the position of the trustified electrical industries was very discouraging. Most of the trusts began operations in the month of January this year, and with regard to the arrangements to once more effect combinations there was an insignificant reserve of cash, which made it impossible to put the business on a genuine commercial basis. The financial position of the electric trusts was complicated further by their not having goods of such a nature as would quickly sell on the market, whilst the products which they did possess, and which might have been bought by the consumer, the latter was not in a position to pay for.

One of the most discouraging features of the electrical business at present is the action of a large number of government establishments which, possessing some reserves of electrotechnical material have been throwing them on to the market at very low prices, practically selling them off, and thus depriving the trusts of the possibility of disposing of their goods in a regular way. There is also to be observed the extremely abnormal position as to giving orders for electro-technical goods abroad. The representatives of the trusts submitted quite a number of cases in which branches of the electrical department, receiving drafts in gold value, have been buying electrical material on the foreign market, altogether indifferent to the interests of the Russian electrical industry, which, it was said, could quite well have manufactured the said goods, and even have delivered them promptly in completed condition. One of the most striking cases of this kind was the arrangement recently made to send an order abroad for cables to the value of 7,000,000 gold roubles, whereas this order could have been executed by the electric trust of Central Russia in a much shorter time, and at prices no higher than those on the foreign market. By taking energetic measures the trusts succeeded in preventing the transfer of this order abroad; but this does not exhaust the question of a better organised treatment of the question of purchases of electrical material from foreign houses.

At the conference there was also discussed the abnormal position of the stores business. Hitherto stocks of electrical materials were not handed over to the trusts, and in some stores electrical property is being jobbed off. Further, it was urged that it was necessary to regulate the importation of raw material and equipment from abroad that might be necessary in the electrical industry, so that, as far as possible, the purchase of goods on the foreign markets might be avoided—that is, of such goods as are made by Russian electrical establishments.

In the discussion the question was raised of realising a portion of the products of the trusts abroad and the necessity for introducing high protective duties on some products of foreign manufacture, particular reference being made to the desirability of putting the production of lamps into the position of a government monopoly, and so on. At the conclusion of the discussion it was observed that the question of the present condition of the electrical industry should be submitted clearly to the governing bodies, indicating that without a close connection with foreign markets by way of export of some electrical materials produced in Russia, and also the introduction in a definite form of foreign capital into the Russian electrical industry, the revival of the latter is impossible. The conference decided to call a second meeting of the representatives of the trust in a short time in order to clear up the very acute problems of the electrical industries.

Scandinavian Amenities.—The Swedish Association of the Electrical Industry has just drawn the attention of the Government to the fact that certain departments of State have not observed the rule that preference is to be given to Swedish manufacturers in making purchases. In the present case the offenders are the Building and Pension Departments, which have purchased Norwegian elevators (lifts) at a price difference of only 10 per cent., and these lifts, the Association states, are considered by the Norwegian State authorities to be inferior to the types made in Sweden.

THE ENGINEERING LOCK-OUT.

SIR WILLIAM MACKENZIE'S REPORT ON THE CAUSES AND CIRCUMSTANCES OF THE DISPUTE.

ON Thursday last week, just after we had gone to Press, the report was published of the Court of Inquiry (Sir William M. Mackenzie, K.B.E., K.C.) appointed by the Minister of Labour, under the Industrial Courts Act, 1919, to inquire into and report upon the causes and circumstances of the Engineering Trades Dispute, 1922, between the Engineering and National Employers' Federations and the Amalgamated Engineering Union in relation to the Memorandum of November 17th and 18th, and between the Engineering and National Employers' Federations and certain other Trade Unions (including the E.T.U.) in relation to clauses 1, 2, and 3 of the same Memorandum. The report is preceded by the following copy of the Memorandum referred to, and by a list of the Unions:—

MEMORANDUM OF CONFERENCE held on November 17th and 18th, 1921.

I. *General.*—1. The Trade Union shall not interfere with the right of the employers to exercise managerial functions in their establishments, and the Federations shall not interfere with the proper functions of the Trade Union.

2. In the exercise of these functions, the parties shall have regard to the provisions for avoiding disputes of 17th April, 1914, which are amplified by the Shops Stewards and Works Committee Agreement of 20th May, 1919, and to the terms of other national and local agreements between the parties.

3. Instructions of the management shall be observed pending any question in connection therewith being discussed in accordance with the provisions referred to.

II. *Overtime.*—It is agreed that in terms of the Overtime and Nightshift Agreement of 29th and 30th September, 1920, the employers have the right to decide when overtime is necessary, the workpeople or their representatives being entitled to bring forward under the provision referred to any cases of overtime they desire discussed. Meantime the overtime required shall be proceeded with.

Signed on behalf of :—

The Engineering and National Employers' Federations:
ALLAN M. SMITH, Chairman.
JAMES BROWN, Secretary.

The Amalgamated Engineering Union:
J. T. BROWNLIE, Chairman.
A. H. SMETHURST, Secretary.

The Court sat at 5, Old Palace Yard, London, on April 28th and May 3rd to 6th, inclusive. Only two witnesses were called (and these appeared for the A.E.U.), but other parties put in a considerable amount of documentary evidence.

The immediate cause of the dispute was a difference between the employers and the A.E.U. as to the interpretation of Clause (j) embodied in an agreement of September 29th and 30th, 1920, concerning the question of overtime, *i.e.*:—

"(j) The Federations and the Trade Union agree that systematic overtime is deprecated as a method of production, and that when overtime is necessary the following provisions shall apply, viz.:—

No Union workman shall be required to work more than 30 hours' overtime in any four weeks after full shop hours have been worked, allowance being made for time lost through sickness, absence with leave or enforced idleness.

In the following cases overtime is not to be restricted—

Breakdowns
Repairs
Replacements
Alterations } Whether for the employers or their customers.
Trial trips.

Completion of work against delivery dates.

So far as repairs to ships are concerned, the removal of restriction on overtime shall not affect the operation of any agreement made by the Union or its constituent Trade Unions with organisations of ship repairing employers."

The agreement from which this clause is extracted was submitted to the members of the A.E.U., and, on a ballot, was accepted by a majority of some 43,000 out of a total vote of some 81,000; it took effect on or about December 19th, 1920.

On December 28th, 1920, a circular letter was addressed to the district delegates of the Amalgamated Engineering Union by the general secretary, which contained the following observations:—

"With regard to Section (j) of the agreement, which deals with the maximum amount of overtime that members are called upon to work, it should be understood that the paragraph implies that it is considered necessary by both parties.

District committees should have due regard to the numbers of men unemployed, and whether such overtime will tend to absorb members who are unemployed."

The employers, on becoming acquainted with the construction which had been placed by the A.E.U. on the clause in question, challenged its accuracy, and the parties met in conference to consider the matter on April 7th, 1921.

The report contains a lengthy narrative of the correspondence, discussions, ballots, lock-out developments, &c., and proceeds to state various considerations relating to these matters. Finally the Court states the conclusions at which it arrived in the following terms:—

(1) *As affecting the Employers and the Amalgamated Engineering Union.*

47. The general conditions in regard to overtime are settled by the overtime agreement of September, 1920, which provides, *inter alia*, that

(*a*) Systematic overtime is to be deprecated;
(*b*) Necessary overtime for breakdown, repairs, replacements, alterations, trial trips, completion against delivery, dates, &c., is to be allowed;
(*c*) Thirty hours in any four weeks may be worked;
(*d*) Rate of payment for overtime is increased to time-and-a-half.

The question of necessity in regard to overtime is related to the requirements of the work to be done and the business in hand, and as to this necessity the management alone are in a position to judge. The National Agreement, allowing 30 hours in four weeks, implies that, up to that limit, overtime, granted its necessity, is regarded as reasonable. Up to that limit there must be freedom to the management to act in the exercise of their discretion. Beyond that limit, overtime would be open to the suggestion that it is unreasonable. The general limit of 30 hours is, of course, subject to further discussion; and if experience shows that the deterrent economic effect of the rate of time and a half is inadequate to prevent unnecessary overtime, there is a case for further negotiation with a view to a revised national agreement.

(2) *As affecting the Employers and all the Unions.*

(*a*) The employers contend that if British engineering is to maintain its appropriate place in the forefront of the industries of the world there must be freedom to the management to introduce such changes into the works as may be necessary for the proper development of the industry. There are general agreements between the national organisations of the employers and the Trade Unions settling many of the conditions of employment in the industry and providing detailed machinery for the discussion of matters arising between employers and employed. It is understood that the employers are willing that the kind of question which has been under discussion during the present dispute should be settled by general national agreement, or determined in accordance with procedure set up by such agreements. This is a view to which the Unions do not take exception.

(*b*) In the ordinary course, a projected workshop change would be more or less common knowledge in the shop for some time before the proposed change was made, but information as to the proposed change in the recognised working conditions should be given to the workpeople directly concerned or their representatives in the shop, and in order that there may be time for discussion, if discussion is desired, the information should be available to the workpeople directly concerned or their representatives in the shop a limited period before it is proposed that the change should be made.

(*c*) The opportunity for prior consultation between the management and the men directly concerned or their representatives in the shop upon proposed changes in the recognised working conditions should be adequate, but should not involve undue delay. If consultation during the limited period mentioned in the last paragraph does not result in an agreement, the further stages of the Provisions for Avoiding Disputes should follow, but in the meantime the management may, if they think it necessary and in the exercise of their discretion, put the change into operation, any subsequent agreement that may be reached upon the case having retrospective effect where appropriate. In the case of those Unions which have not yet any provisions for avoiding disputes, a simple procedure should in the meantime be adopted to deal with changes in the shop.

(*d*) It is evident that the opposition to change on the part of the skilled men is due largely to the uncertainty which the members of the Unions feel as to their position if they are displaced as a result of the change. An expanding industry like the engineering trade is capable of making readjustments affecting particular classes of workpeople, while at the same time providing for the proper utilisation of the skill thus set free.

An agreement to the principle of making such arrangements as shall provide avenues of employment for such men ought not to be difficult; and as the success of any change depends largely on its willing acceptance by the men, the measure of such acceptance will depend on the action of the employers, in conjunction with the Union, in accommodating in skilled employment the men set free.

It will of course be understood that the changes referred to, which are the subject of difference between the parties, are not changes in such matters as wages and hours, which are determined on a national basis.

48. These conclusions doubtless require elaboration, and require to be stated with greater preciseness for the purpose of any formal agreement between the parties. In my opinion, however, the matter is one in which no agreement, however carefully devised, can wholly take the place of good sense and good will between the parties, and an appreciation by either side of the difficulties and point of view of the other. The managing of a business is a responsible and difficult task, and no individual workman or Trade Union official should unnecessarily or without good cause add to its anxieties. Similarly, each employer, and those acting under him, should recognise that, in his more restricted sphere, the workman is conscious that issues are sometimes at stake which are of the utmost importance to him and upon which consultation and, as far as possible, accommodation may be the wisest as well as the most humane policy.

Sir William Mackenzie expresses high appreciation of Mr. Godfrey H. Ince's services and assistance, as Secretary, during the course of this inquiry.

PARLIAMENTARY NOTES.

(FROM OUR SPECIAL PARLIAMENTARY REPORTER).

Grampian Electricity Supply Bill.—When the Select Committee of the House of Commons which has been considering this Bill met on May 9th, it was announced that agreement had been reached on all points in dispute with regard to the protection of proprietorial rights and other matters. The Committee then formally examined the Bill and adjusted the Clauses and ordered the Bill to be reported to the House.

In the House of Commons, on May 10th, Mr. Briggs asked the Chancellor of the Exchequer if he was aware that the promoters of the Grampian Electric Supply Bill had received a letter, dated April 20th, 1922, from the secretary of the Trade Facilities Act Committee stating that, subject to the approval of the Electricity Commissioners, the committee would be prepared to recommend a guarantee of both capital and interest of the debenture issue of the company equal in amount to the ordinary share capital of the company; and was he satisfied that the commercial future of this company warranted the use of public money to guarantee capital and interest to such a proportion of debenture issue?

Sir R. HORNE replied that he stated during the passage of the Trade Facilities Act that he proposed to be guided in the guarantees given under the Act solely by the advice of the Trade Facilities Act Advisory Committee, which consisted of three business men of very great experience and ability. He understood that the committee was prepared to recommend a guarantee in this case provided the scheme matured in time.

L.C.C. (Tramways and Improvements) Bill.—This Bill (the title of which has been changed from the L.C.C. (Tramways, Trolley Vehicles and Improvements Bill) came before a Select Committee of the House of Commons on May 10th, Mr. Ormsby-Gore presiding. When the Bill received a second reading it contained a proposal that powers should be given to construct a trolley tramway to be run from Norwood Road to the Crystal Palace. It was stated that as the local authority, the Lewisham Borough Council, had exercised its right of veto, that part of the scheme had been dropped. The remainder of the Bill was concerned with the construction of an electric tramway of about five-eighths of a mile along Amhurst Park, connecting the L.C.C. tramway in Stamford Hill and that of the Metropolitan Electric Tramways Co., which opposed the Bill, in Seven Sisters Road. It was explained that the local authorities concerned desired that the tramways should be made. The only opposition came from the Metropolitan Electric Tramways Co.

The CHAIRMAN said that the Committee had unanimously agreed to pass the Bill. If the ground for rejecting the Bill was to be congestion, the Committee would have expected that the Ministry of Transport and the police authorities would have had some observations to make, but no such observations had been made. It did not seem that the property of the Metropolitan Electric Tramways Co. would be damaged or in any way rendered less valuable or would be prejudiced. The Committee, therefore, ordered the Bill to be reported to the House.

Ayr Burgh Electricity Bill.—A Select Committee of the House of Lords, presided over by Lord Bristol, began the consideration of this Bill on May 9th. The measure has been promoted by the Corporation of Ayr with the object of empowering it to construct generating stations and works, and to utilise the waters of Loch Doon for the purpose of generating electricity for the burgh of Ayr and the surrounding district to be included in the extended area of the Corporation. The promoters intend to augment the existing supply of electricity, which is generated by steam in the burgh, and which is found to be inadequate. Originally there were ten petitioners against the scheme, but three of these have withdrawn, among the remaining petitioners being: the County Council of Ayr, the Kilmarnock Town Council, the Doon Fishery Board, the River Doon Syndicate, and the Marquis of Ailsa.

Mr. H. P. MACMILLAN, K.C., for the promoters, said that if they were permitted to proceed with the scheme, the Corporation would be enabled to double the output of the existing plant, and so meet all requirements. The hydraulic works would cost about £113,000; the power station and equipment £43,000; the transmission system £58,000; and the general costs £6,000; a total of £220,000. The present charges to the consumer were very low, and were regulated by the Order of 1890. For any amount up to 20 units 13s. 4d. was charged, and for each unit over 20 8d. per unit, with a provision that 20 units would be supplied. It was proposed in the present Bill to increase the charge to 1s. per unit. It was also proposed to extend the area supplied with electric power by the Corporation. The scheme would involve the acquisition of the necessary land, the erection of a power station, and the turning of Loch Doon into a reservoir. The raising of the level of the loch by 5 ft. would not involve the submergence of land of any importance, while with regard to the sluices at the loch, the Corporation desired to have control of these, with certain safeguards. There was a fall of 120 ft. in three-quarters of a mile from the entrance of the loch, and this was admirably suited for the purpose in view. The crux of the whole scheme was the generation of the water power through that three-quarters of a mile.

Mr. SANDEMAN, K.C., for the Kilmarnock Town Council, said that Kilmarnock had made arrangements to supply Ayr and the surrounding district with electrical power, and increased its power station on the understanding that a bargain which had been entered into with Ayr would be ratified. This "little toy scheme" of Ayr was extravagant in the highest degree.

The Committee adjourned, and at the resumed hearing, on May 10th, Mr. MacMillan said that the Ayr County Council had withdrawn its opposition on terms agreed on. The promoters would not press for an extension of their supply area in the southern part of the county, but asked that they should not be precluded from supplying electrical power in the county if they so desired. After hearing evidence the Committee again adjourned.

Further evidence was heard on May 11th, and the Committee again adjourned.

Miscellaneous Bills.—The Yorkshire Electric Power Bill and the Great Northern Railway Bill have been read a second time in the House of Commons; and the Bristol Tramways Bill and the Nottinghamshire and Derbyshire Tramways Bill have been read the third time. The Ayr Burgh (Tramways, &c.) Order Confirmation Bill has been read a second time. The South Wales Electrical Power Distribution Co. Bill has been read a third time in the House of Lords and passed, as has also the Metropolitan Railway Bill.

State of Trade and Industry.—Mr. Stanley Baldwin, the President of the Board of Trade, during a discussion on the Board of Trade Vote in the House of Commons on May 11th, said that the coal trade was the only one which, after protracted and very severe suffering, had got down to an economic level, and the result had been that the coal trade was the only one in which the export trade had come back to something like the pre-war average. For the country nothing could be of greater importance, because coal was one of our most valuable exports, and until we could begin to export freely we should not begin to find the machinery for paying for our goods. The iron and steel trades were going through a very difficult time, but it was something to see orders coming in. The only thing for that trade, and the only thing for all, was patience and hard work. The right hon. gentleman gave favourable reports of the cotton, woollen, hosiery, leather, and chemical trades, and said that the electrical trades were fairly busy. The textile machinery trade had been very busy.

Industrial Unrest.—Last week the Minister of Labour was asked whether he could state the national loss in time and wages, respectively, through industrial unrest in the last two months.

Dr. MACNAMARA said that the aggregate time lost in March and April in trade disputes involving stoppages of work was estimated to have amounted to approximately 9,000,000 working days. This figure included time lost by workpeople thrown out of work owing to the disputes at the establishments where the disputes occurred, as well as by those workpeople actually on strike or locked out, but it did not include time lost by workpeople rendered idle at other establishments, as to which figures were not available. The information in his possession was not sufficient to enable him to give a reliable estimate of the aggregate loss in wages resulting from the disputes.

Broadcasting to Ireland.—Mr. O'Neill asked the Postmaster-General whether wireless telephone receiving instruments installed under the new scheme in Northern Ireland would be within reach of any of the broadcasting stations in Great Britain; and, if not, would he say what steps he proposed to take to enable the public in Northern Ireland to take advantage of the facilities recently announced, in view of the fact that the Post Office in Northern Ireland was still administered wholly by the Imperial Government.

Mr. Kellaway said that if a broadcasting station was erected at Glasgow under the new scheme it could, no doubt, be heard in Northern Ireland, but better results would probably be obtained if a station were eventually erected in that area. In view of the present position in Northern Ireland licences were not at present being issued, but when the situation became more normal the claims of that area would not be overlooked.

North Metropolitan Electric Bill.—The Unopposed Bills Committee of the House of Lords had before them on Tuesday a Bill to confer further powers on the North Metropolitan Electric Power Supply Co. to provide for the vesting in the said company of the undertakings of the North Metropolitan Electric Power and Distribution Co., Ltd., and the dissolution of that company and for other purposes. There was no opposition, and the Bill was passed for third reading.

Electricity (Supply) Bill.—On Monday last Mr. Neal (Parliamentary Secretary to the Ministry of Transport) moved the second reading of the Electricity (Supply) Bill in the House of Commons. He reviewed the history of legislation affecting electricity in this country, and after explaining the provisions of the Bill, said that it proposed to complete and make workable the measure of 1919. It gave the joint electricity authorities, subject to the approval of the Electricity Commissioners, power to borrow, and those persons interested power to lend, in respect of electrical undertakings. Since 1919 no fewer than 930 applications for borrowing had come before the Commissioners, and 865 of these had been dealt with; 243 out of 253 applications relating to price revisions had been disposed of; and 75 Special Orders had been made. He emphasised the fact that while other countries were developing their power supplies from natural sources and competition in industry was becoming keener than ever, we were dealing with a wasting asset in our coal supply. It was a scientific fact that in the production of steam power 80 per cent. of the calorific value of coal was lost, and while individual manufacturers were put to the cost of restoring their own power-producing plants, we were by those means handicapping the development of industry. The Bill would be of value in relieving unemployment in the best possible way.

The rejection was moved by Mr. G. Balfour, who said that he wished to secure proper and adequate control by the House of Commons over the finance of the large authorities proposed to be set up under the Act of 1919, not one of which had been created. He contended that financial powers should be given to the joint electricity authorities by Provisional Orders, which orders should be laid before Parliament for confirmation. By this measure of Parliamentary control some safeguard against waste would be provided.

Sir R. Clough seconded the rejection.

Sir Philip Dawson expressed a fear that certain clauses would be likely to make electricity dearer rather than cheaper.

Mr. Myers, on behalf of the Labour Party, supported the general principles of the Bill.

The debate was adjourned at 11 o'clock.

LEGAL.

Westminster Electric Supply Corporation, Ltd., v. Wykeham Studios, Ltd.

Mr. Justice Swift was engaged in the King's Bench Division on May 9th and 10th in hearing an action by plaintiffs against the Wykeham Studios, Ltd., of 165, Victoria Street, Westminster, to recover a balance of account for electricity supplied. The case raised an interesting question whether energy used for arc lamps in photographic businesses should be charged at lighting or power rates.

Mr. W. S. Kennedy appeared for the plaintiffs, and Mr. G. R. Blanco White was for the defendants.

Mr. Kennedy, in opening the case, said that the claim was for £82 18s. 5d., and defendants had admitted £48 5s. 10d., so that a comparatively small amount was in dispute. There was no dispute as to the quantity of energy supplied—the sole question being as to the rate which plaintiffs were entitled to charge for energy used in arc lamps for taking photographs. The defendants claimed that the charge should be at the power rate, but the plaintiffs said that they were entitled to charge up to the maximum so long as no undue preference was shown. In July, 1913, the defendants entered into a contract to take a supply for certain lamps for lighting purposes and for a photographic arc lamp, which agreement provided for a lighting rate of 4½d. per unit. The photographic arc lamp being on a separate circuit, was charged for at a lower rate. In 1916 the plaintiffs claimed to alter the terms of supply, and gave notice to the defendants. This provided for a certain number of incandescent lamps for lighting and one 50-ampere photographic arc lamp at the penny rate, which was continued up to May, 1921. After 1916 there were increased costs of production, and the plaintiffs gave notice of an increased charge for the arc lamp, viz., the ordinary lighting rate. There was no suggestion in this case that it was necessary to supply power at one rate and light at another. No suggestion was made in the defence that any undue preference had been given. Such a construction of the Act as the other side was contending for would lead to a state of affairs never contemplated by the Legislature or anyone connected with the Act. It was impossible for any undertaking to supply a person using a small arc and for a short time at the same price as it would supply power to a railway company. Referring to the defendants' affidavit, counsel said that they claimed to continue the use of the arc lamp at the power rate because they had hitherto been supplied at that rate. He did not admit that it was a power rate because it was charged at power rate. The company had a power rate, and it would vary according to the circumstances under which it was used.

His Lordship: Does it concern you to say that this is separate from the power rate, seeing that you have the right to fix the power rate according to circumstances?

Mr. Kennedy said he did not know that it did. If the plaintiffs were entitled to vary the power rate, which he was not concerned to deny, the defendants were supplied for power.

His Lordship said that upon the facts he was inclined to think that this was energy supplied for power purposes, and the plaintiffs' case was that it was a supply in which they had a right to differentiate as to the rate at which they charged. The defendants appeared to have assumed that there was no right to differentiate in the charges for power.

Mr. Blanco White said he did not wish to put his case higher than it was. His point was that they might charge him the power rate if they did not charge more than the maximum, and that, he contended, was what they were doing.

His Lordship: You are complaining of undue preference because they are charging you more than they are charging other users for power purposes, although somewhat less than the lighting rate.

Mr. White said he contended that they were in the power class, and were entitled to be charged not more than the least favoured of power users. What the company had done was to slightly alter its form of agreement and call it a general form of agreement for supplying electrical energy. They originally took supplies in 1916, which terminated in 1921, and they were charged the lighting rate until Christmas, 1921, when they entered into an agreement, and the Corporation admitted that it was not a power charge at 4d. a unit. His clients were not parties to that agreement, and they said that the charge for power was 2d. or 1½d. per unit, and, as defendants were in the power class, they said that they were being charged more than the maximum for power, as they were asked to pay 4d. instead of 1½d. The power charge was originally 1d., but had gone up during the war.

His Lordship: They are making a new class altogether.

Mr. White said the Photographic Association had admitted it was not power, and in consideration of that admission they had got a reduction of 2d., but defendants were not bound by that, and in consequence the matter was now before his Lordship.

His Lordship pointed out that the members of the Photographic Association were paying a different rate from other light and power consumers.

Mr. White said he relied upon the company's advertisement that it supplied electricity for power purposes at 1½d. per unit.

Mr. Kennedy admitted that the company offered to supply electricity for the purposes of power at 1½d. per unit; that was a price adapted to some cases, but not to every case. In each case a special charge was made. They were charging defendants the same rate as every other consumer in the district who was using the current for the same purpose under similar circumstances. The defendants had had an agreement subject to three months' notice to terminate. Unless the defendants went to the length of saying that a fixed sum must be paid by all power users, they must fail. There was no evidence of undue preference. Neither did Mr. White think his clients were charged above the maximum. In the circumstances, he said, the company was justified in charging defendants 4d. per unit.

His Lordship said the case raised important points in connection with the supply of electricity, and he would reserve his judgment.

Porter v. Mayor, &c., of Ipswich.

On May 11th, before a King's Bench Divisional Court, the Rev. Edward W. Porter appealed for the reversal of a decision made by Judge Marchant at Ipswich County Court. Plaintiff had applied for damages and an injunction against the Corporation on account of the erection of electric lighting poles upon a bank bordering his property and a public road. The County Court judge held that the poles were erected on public property, and dismissed the action.

Mr. Hawke, K.C., for appellant, said that Mr. Porter's property was bounded on the highway side by a bank extending about 600 ft. along the road. In correspondence the Corporation had contended that this bank had slipped forward, owing to rain and snow, and encroached 4½ in. upon the highway. The Corporation also pleaded its statutory titles as lighting authority.

Mr. Montgomery, K.C., for the Corporation, said that the Corporation wished to establish that, as a lighting authority, it had power to put posts into land, the surface of which was dedicated to the public as highway. He maintained that the roadway extended from the hedge on one side of the road to that on the other side.

Mr. Justice Bray said that this was a fallacy, as a boundary fence included the hedge and the bank on which the hedge was situated.

Mr. Montgomery said that the bank on which the hedge was placed was 2 ft. high, and horizontally from the line of the hedge to the edge of the grass was 2 ft. 6 in.

Mr. Hawke asked that the case should not be sent back but decided at once. Mr. Porter had thrown the onus of proof upon the Corporation, which had failed to discharge it.

In giving judgment, Mr. Justice Bray said that it was argued that what the County Court judge found was simply that the particular points where the poles were put did not belong to the plaintiff; it was not disputed that the poles were put on the slope of the bank. The judge undoubtedly found, and wrongly, that the whole of the bank belonged to the highway. The Corporation, as to the four poles, must be found trespassers. Regarding two of the poles, the digging of which plaintiff said disturbed his sub-soil, the Corporation pleaded Section 2 of the Gas Works Clauses, 1847, which it said entitled lighting undertakers reasonably to break the surface of dedicated roads. The appellant said that a following proviso required that, where the land of a private owner was to be disturbed, his consent must be first obtained. Six feet was a reasonable depth for the poles, and no structure beneath was interfered with. The plaintiff must, therefore, lose on his contention as to these two poles. He also complained of the cutting of a tree, to which, the Corporation said, Mr. Porter's sister had given sanction. Miss Porter had no authority to do this, and Mr. Porter objected. The plaintiff would be given the nominal damages of 5s. for the cuttting of the tree, 40s. damages for the placing of the four poles, and his injunction against the electric lighting authority, with costs, except that he must bear the additional costs, if there were any, of his plea with regard to the digging for the two other poles.

Mr. Montgomery asked for leave to appeal, as it might be a serious matter if the Corporation had to remove the wires and was unable to give a supply of electricity to an applicant. It might be that the proper course was to consult the Electricity Commissioners under the statutes. Leave to appeal was refused, but the appellant agreed to a limited stay of execution.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Joints Behind Switches.

We were interested in the series of replies to Mr. Martin Coleman's letter, with regard to a form of connection terminal in switches.

From our point of view, the connection terminal is very useful, but we think it a rather dangerous thing to use in view of the fact that it exposes the "feeds" to possible abuse and other disadvantages.

Mr. Martin, presumably like a good many more, is "fed up" with the form of porcelain connector, with its little screws that often chew the wires in half, and the porcelain protection that has considerable surface leakage, and other troubles too numerous to mention.

We are one of those firms that are also "fed up," as the saying goes, so we turned to and devised our own connector, which is now incorporated in our recently protected wiring system (which, by the way, is based upon the cost per outlet and our experience as contractors).

We send you two cards descriptive of our connectors which, we trust, will interest many of your readers.

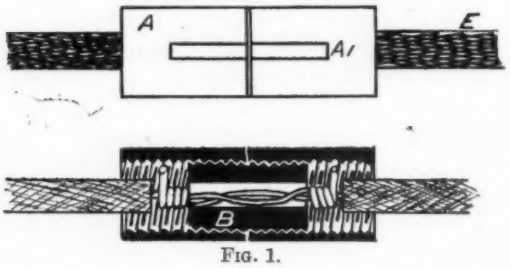


Fig. 1.

Fig. 1 shows an enlarged view of the all-metal or all-insulation connector. The connector comprises three members—an insulated or metallic core, externally screw-threaded, B, and two sleeves, A, internally screwed to fit B, having slits cut in them at A_1. In the working of this connector, the ends are prepared in the usual way, and the sleeves are slipped over them; the bared ends of the cable or wire are then threaded through the bore of the core and their extremities are set down at right angles.

The sleeves are then brought up and the sleeve slits made to engage the wires; the subsequent act of screwing the sleeves on the core tends to wind the extremities of the wires around one another, as shown in the section. In a modification of this we are putting copper tube inserts in the core, which we hope will considerably increase the conductivity and mechanical strength of the bond. We may say that the metallic connector is for use with non-insulated wires or cables. The connector is simple, requires no tools, and makes a sound reliable joint of copper to copper with considerable strength.

Figs. 2 and 3 show our "Pill-box" connector, which is used principally to form the connections in the tee boxes, used in the wiring system, and by which we are able to put a large number of joints comfortably in a very small space and be perfectly sure of their insulation reliability. Fig. 2 shows the

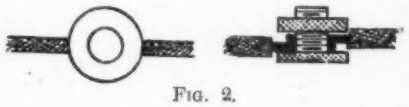


Fig. 2.

form of metallic bond of the wires, which has the advantage of being securely made without possible damage to the wires, and without obstruction by any surrounding objects. After this joint has been made, the rubber box, fig. 3, lined internally with para, is taken in which the joint is placed. In order to get the joint into the box, it is parted open at the

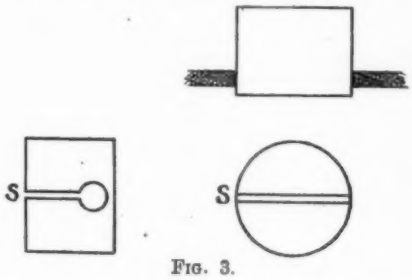


Fig. 3.

slit S, wide enough for the joint to pass and lie snugly in the box. With proper formation it is quite an easy matter to get as many as four connections in the area of, say, an ordinary ¾-in. conduit tee.

We hope shortly to put these on the market, and if any of your readers wish for further information we shall be most pleased to give it at any time.

George Humphry,
Bristol, *May 15th*, 1922. *Humphry Electric Co.*

The Cost of Living in India.

Referring to the correspondence regarding the cost of living in India and the letter from Mr. Lee, it is rather interesting to note the very rapid rise in prices which must have taken place within three years from the time he mentions.

I came to Calcutta 27 years ago, and although I could not afford to live in one of the best parts of the town, my minimum living expenses, without allowing anything for doctor, holidays, or recreation, were Rs.185 per month, and I had precious little enjoyment in life out of that.

However, what happened 30 years ago is of little use to men proposing to come out here now, and from my experience a man who once comes out here and stays out here any time has little chance of obtaining work elsewhere afterwards; he must, therefore, be prepared to stick it for the rest of his working days, which may be considerably shortened by the climate or his mode of living.

At the present time, for a young unmarried man who wants to put a bit by, it is useless to start on less than Rs.500 per month, and for a married man Rs.1,000 is on the low side if he wishes to give his wife any comfort and send his wife and family (if any) home within a reasonable time.

The whole cost of living out here is inflated to such an absurd extent that the game is not worth the candle; there is little comfort except for people with plenty of money, and half a loaf at home of British bread is worth a very large whole one of Indian.

My advice, therefore, to those who propose to come out is "don't," especially if you are married, unless you want to spend the rest of your working days in India, and also, if married, be separated most of the time from your family.

Calcutta. **"Battiwallah."**
April 27th, 1922.

Opportunities for Business.

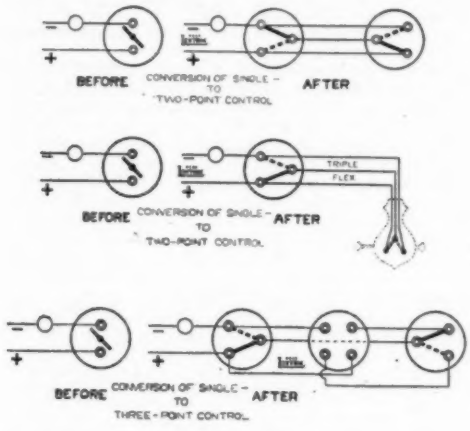
In view of the present cost of materials and labour, many of those who have electric lighting installed are prevented from appreciating to the full extent the advantages secured by the use of improved methods of switching. Possibly it may not be generally known that many of these facilities are easily obtainable at little expense, and practically without alterations to, or interference with, the existing wiring.

For instance, conversion from single to two-point control in such places as bedrooms, offices, staircases, halls, passages, &c., means the simple replacement of the existing switch by a two-way; from the latter switch a triple-flexible cord can be carried to the position where the extra control is required, at which point a second two-way switch is fixed. Three-core cable, with metal or other sheathing, can of course be used, if desired.

This conversion from single to two-point control is shown in the first two diagrams of the accompanying figure.

Should similar control be required from a third, or even a fourth, position, the third diagram shows the simple extensions which give the desired result. Where more than two switches are used, the additional ones must be of the intermediate pattern.

If preferred, both the end and intermediate positions can be arranged with pendant-pattern switches, and in such cases



the flexible cords may be conveniently suspended from ceiling roses, those being three and four-plate respectively.

Such conversions would provide remunerative employment for a contractor during these lean times, and assist in building up a goodwill among his clients, who will appreciate the conveniences of improved control obtained at such small cost. With improved trade conditions, such contractors will undoubtedly be the first to reap the benefit, by receiving additional work from their satisfied clients, or from such clients' recommendations.

Judicious circularisation, pointing out the advantages gained by improved controls, viz., convenience and economy, and the ease and cheapness of conversion, would undoubtedly bring good results.

A. P. Lundberg & Sons.

London, *May 9th*, 1922.

Prospects in the Argentine.

I have read with much interest Mr. Bernard Drake's letter published in your issue of the 12th instant, with regard to the above.

I fear I must agree in every respect with what his agent says with regard to British *versus* American and German products. The same state of affairs exists, I believe, all along the South American Continent from my own experiences, whilst in Brazil (Bahia), articles of British manufacture were exceedingly hard to obtain, and when it was possible to get them, prices were absolutely beyond the reach of all except the wealthiest.

Without going into details, I might add that I never remember having seen in the city of Bahia anything but American and German automobiles, and in the shops practically everything was of German or American manufacture.

One of the greatest reasons, I believe, why English goods have not a ready market, in Brazil at least, is the fact that there are no catalogues of British manufactured articles printed in the language (Portuguese).

There are, of course, numerous trade journals printed in Spanish, but these are only sent to subscribers, and in many cases, only to the Consulate, where they lie piled one upon the other year in and year out, and are never used unless specially called for. Not so with German publications, for I remember it was quite a regular thing for our house, and indeed every other of the slightest repute, to receive catalogues of all classes of goods printed in the native language and sent out periodically from Germany.

It is all very well for people to say that English is now spoken by every educated foreigner, but the Brazilian is naturally going to pay much more attention to periodicals printed in his own language, and this, of course, applies to the many thousands who do not speak, what to them is a very difficult language to learn—our own.

Francis A. Hutchinson.

London, *May 15th*, 1922.

The Load Power Factor and its Measurement.

I have read with interest the article describing some instruments manufactured by Messrs. Everett, Edgcumbe for the measurement of power factor. As far as my experience goes, a recording instrument of the type described would not be of much commercial value, as both the supply undertaking and the consumer are concerned chiefly with the power factor at the time of maximum demand.

A tariff that incorporates a charge based on average power-factor conditions is doomed to fail commercially, and I think it is evident from all that has been written and said on the subject in recent months that a two-part scale for kVA demand and a running charge per unit is the only scale likely to meet the need, or a variation which would give a similar result. What, therefore, is very badly needed is an integrating watt-hour meter to record the units, with a demand indicator to give the demand in kVA with a time lag of say 15-30 minutes as may be required.

To my knowledge certain makers are busily engaged on instruments of this kind, and I think we may confidently hope that in the near future a satisfactory instrument will be brought on the market. Undoubtedly Messrs. Everett, Edgcumbe's recording instrument will be of value in conducting certain tests, &c., but I do not see how it can be applied for ordinary every-day commercial use.

E. W. Dorey.

London.
May 16th, 1922.

BUSINESS NOTES.

Bankruptcy Proceedings.—F. Ridgway and T. Tynan (Ridgway & Tynan), electrical engineers, 21, Bowling Old Lane, Bradford.—Receiving order made May 8th on debtors' own petition. First meeting, May 19th, at the Official Receiver's Offices, Bradford; public examination, May 24th, at the County Court, Bradford.

G. Hill, G. Noble, and E. Cowley (G. Hill & Co.), electrical engineers, 22, Chantry Lane, Great Grimsby.—Receiving order made May 6th on debtors' own petition. First meeting, May 20th, at the Official Receiver's Offices, Great Grimsby; public examination, June 1st, at the Town Hall, Great Grimsby.

William Walton Threapleton, Thornbury Road, Bradford, electrical and mechanical engineer.—The first meeting of creditors was held on May 10th at the Official Receiver's Offices, 12, Duke Street, Bradford. The statement of affairs showed a deficiency of £309. The matter was left in the hands of the Official Receiver as trustee of the estate.

A. R. Gibbons, electrical engineer, 8, The Parade, New Eltham.—Receiving order made May 9th on creditor's petition. First meeting, May 22nd, at 29, Russell Square, W.C.; public examination, June 20th, at the Court House, Greenwich.

W. F. Rimmer, electrical engineer, 21, Ellesmere Street, Patricroft.—First meeting, May 23rd, at the Official Receiver's Offices, Manchester; public examination, June 15th, at the Court House, Salford.

J. Owen (J. Owen & Sons), electrical engineer, 186, Westcombe Hill, and 3, The Grove, Greenwich.—First dividend of 2s. 3d. in the £, payable May 30th at 29, Russell Square, W.C.

W. A. Davis, electrical engineer, late of 3, Coronation Street, Leeds.—First and final dividend of 2½d. in the £, payable May 25th at the Official Receiver's Offices, Leeds.

H. M. Wollman, electrical factor, late of 9, Greasboro Road, Parkgate, Rotherham.—First and final dividend of 4s. 4½d. in the £, payable at the Official Receiver's Offices, Sheffield.

R. S. Magson (R. S. Magson & Co.), electrical engineer, 10, Stoney Stanton Road, Coventry.—Receiving order made May 11th on debtor's own petition.

T. Carter, electrical engineer, 2, South Street, Dorchester, and High Street, Swanage.—Receiving order made May 11th on creditor's petition.

J. H. Hopkins (Electrical Maintenance Co.), 57, Castellaine Mansions, Maida Vale, London, W.—Application for discharge to be heard at Carey Street, June 16th.

Company Liquidations.—Park Bros., Ltd.—Winding up voluntarily. Liquidator: Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C. Meeting of creditors, May 19th, at the liquidator's offices; particulars of claims by June 23rd.

Portarlington Electric Light & Power Co., Ltd.—Particulars of claims by June 22nd to the liquidator, Mr. M. Crowley, 16, College Green, Dublin.

Redglo, Ltd.—Meeting June 15th at 5, Castle Street, Liverpool, to hear an account of the winding up from the liquidator, Mr. E. J. Walker.

Spiral Flexible Metallic Tubing Co., Ltd.—Winding up voluntarily. Liquidator: Mr. A. France, West Bar Chambers, Boar Lane, Leeds.

Beta Batteries, Ltd.—Winding up voluntarily. Liquidator: Mr. J. A. Cameron, 5, New Court, Lincoln's Inn, W.C.2. Meeting of creditors at the liquidator's offices, May 26th. Particulars of claims by June 17th.

Aqua Electric Co., Ltd.—Winding up voluntarily. Liquidator: Mr. C. H. McKnight, 36, New Broad Street, E.C.2. Meeting of creditors May 29th, at the Institute of Secretaries, 59a, London Wall, E.C. Particulars of claims by July 10th.

Perna Engineering Works (Blackpool), Ltd.—Meeting called for June 20th at 97, Church Street, Blackpool, to hear an account of the winding-up from the liquidator, Mr. T. Greenhalgh.

British Utilities, Ltd.—Meeting called for June 22nd at 54, New Broad Street, E.C., to hear an account of the winding-up from the liquidator, Mr. H. Morgan.

Deed of Assignment.—W. L. Knight (W. L. Knight and Son), electrical engineer, 6, Oak End Waye, Gerrards Cross.—Particulars of claims to be sent by May 26th to the Trustee, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.

Receiver Appointed.—Mr. Charles Comins, F.C.A., of 50, Cannon Street, E.C.4, has been appointed receiver of Higntensite, Ltd., on behalf of the debenture-holders.

Trade Announcements.—The Wayne Engineering and Equipment Co., Ltd., has opened branch offices at Manchester, Birmingham, Norwich, Kendal, Newcastle-on-Tyne, and Glasgow. That at Manchester is at the Efandem Co., Ltd., 28, Queen Street, Albert Square, Manchester.

His premises in Packer's Row, Chesterfield, having been demolished, Mr. Edgar R. Morris, A.M.I.E.E., electrical engineer, has taken temporary premises in Elder Yard.

The Metallic Electrical Engineering Co., Ltd., has changed the address of its Manchester branch to 63, Bridge Street, Deansgate.

The Electrical Maintenance Co., of 103, Cambridge Street, Glasgow, was registered in Scotland last month. The company has a branch in Edinburgh for electrical repairs and maintenance.

We are informed that Mr. A. De Jong, 32/34, Holborn Viaduct, London, E.C., has been appointed agent in Great Britain and Ireland for Messrs. Philips Glowlampworks, Eindhoven, Holland, for the sale of their carbon, candle, showwindow "Savelite," and telephone lamps and electric fittings.

Catalogues and Lists.—Messrs. Adam Hilger, Ltd., 75a, Camden Road, N.W.1.—An illustrated description (with prices) of the "Hilger" chemical spectrometer.

Materiel Electrique Alex Lefebvre, 9, Rue Arsène Houssaye, Paris (VIII).—Lists of plant for sale, including generating sets, engines, rotary converters, transformers, a.c. and d.c. generators, pumping sets, &c.

Superlamp, Ltd., 197, Old Street, E.C.2.—Leaflet advertising the "Superadio No. 1" wireless telephony receiving set.

Sterling Telephone & Electric Co., Ltd., 210-212, Tottenham Court Road, W.1.—Publications No. 318, dealing with ironclad telephones fitted with throat microphone transmitters; and No. 321, advertising telephone receivers for wireless telephony and telegraphy.

Messrs. Sims & Sims, Stanhope Terrace, Gloucester Gate, N.W.1.—An illustrated booklet describing the "Sims" small lighting and power plant ranging from .5 to 6.4 kW.

Foster Engineering Co., Ltd., Morden Works, Wimbledon, S.W.19.—A price list of "Crown" cables and tapes.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Booklet No. V.2,754, giving illustrations and reduced prices of "Freezor" electric fans of various types.

British Insulated & Helsby Cables, Ltd., Prescot, Lancs.—Publication No. P174, a list of cables supplied, to a number of authorities, for working pressures of 11,000 V and above. This includes several for 33,000 V. and one for 100,000 V, d.c., supplied to the Metropolitan E.S. Co., Ltd.

We have received a copy of "World-Wide Publicity" published by Messrs. Fredk. E. Potter, Ltd., advertising agents, of Imperial House, Kingsway. It is brought out in celebration of their semi-jubilee, it being 25 years since the business was started by Mr. F. E. Potter, who is still in active management.

For Sale.—By direction of the Disposal Board, Mr. M. Marshall will hold a six-days' public sale of machinery, power, and generating station plant, &c., at the Central Stores Depôt, Georgetown, near Glasgow, commencing June 12th.

Assets Auctions Co., Ltd., will sell by auction, on May 24th, at 119-121, Newington Causeway, the stock of an electrical goods factor.

Sunderland Corporation Electricity Department has a quantity of arc lamp carbons for disposal.

Cardiff Corporation Electricity Department invites offers for two Musgrave Lancashire boilers, 30 in. by 8 in., 150-lb. working pressure, with superheaters, mechanical stokers, one 300-kW G.E.C. motor generator, with control panel, travelling crane, &c. (See our advertisement pages to-day.)

Book Notices.—"Central Electric Stations in Canada" (Census of Industry, 1919) (56 pp.). Ottawa, Canada: Dominion Bureau of Statistics.—This publication gives, in tabular form, abundant information of a varied nature, regarding the electricity supply industry of Canada. Among the figures given may be mentioned: the total investment in undertakings; the power produced; stations grouped in accordance with their nature, *e.g.*, steam, oil, or hydraulic, or d.c. or a.c.; the number of employés; the mileage of transmission and distribution lines; and a great deal more. The information is given both for Canada as a whole and for individual provinces.

"A.C.E.C. Bulletin," April, 1922 (32 pp.). London: Ateliers de Constructions Electriques de Charleroi.—This number contains articles and notes (in French) upon the A.C.E.C. works; the application of electricity to rolling mills; centrifugal pumps; high-pressure cables; winding engines, &c.

"Electro-Farming," by R. Borlase Matthews, Wh.Ex., M.I.E.E., &c. (46 pp., illust.). London: The Electrical Development Association, Inc. Price 1s.—This is a reprint from *De Ingenieur* of a paper read before the Electrotechnical Section of the Koninklijk Instituut van Ingenieurs, at Nijmegen, Holland. It deals very comprehensively with the numerous applications of electricity to farming operations, &c., and includes illustrations of a number of cases in which electrical power has been employed with success. As in his I.E.E. paper, Mr. Matthews recounts his own experiences in the use of electricity on the farm.

"Modern Practice in Heat Engines," by T. Petrie. Pp. xii +264; 113 figs. London: Longmans, Green & Co. Price 15s. net.

"Electric Power Systems," by W. T. Taylor. Pp. xii+108; 9 figs. Price 2s. 6d. net. "High Voltage Power Transformers," by W. T. Taylor, pp. x+118; 26 figs.; price 2s. 6d. net. London: Sir I. Pitman & Sons, Ltd.

The Cost Accountant, the official journal of the Institute of Cost and Works Accountants, commences its second volume with the June number, and will contain the first instalment of a new series of articles by Mr. C. W. Charlesworth, F.C.W.A., entitled "The Interpretation and Analysis of Electricity Supply Costs."

"The Year-Book of Wireless Telegraphy and Telephony for 1922." London: The Wireless Press. Price 15s.

The "Special Articles Section" of this issue deals with the improvements made in the aerial and earthing systems of high-power stations and the development of high-speed working. In this connection articles by Dr. Meissner on "The Earthing Resistance of Antennæ" and on "The Recording of Wireless Signals," by Dr. Abraham, are included. Other additions to this section are articles on the history of long-distance wireless telegraphy and "The Rectification Effect in its Relation to the Composition and Structure of Crystals." Other new features of interest are a list of the licensed amateurs' transmitting stations in this country, and a map which enables the distance of the world's wireless stations from London to be ascertained without difficulty. All recurring information has been brought up to date and added to.

"The Beginner's Guide to the Microscope," by Chas. E. Heath. (118 pp.) London: Percival Marshall & Co. Price 1s. 6d. net.—This work describes the principles and construction of microscopes, and deals with such points as achromatism, magnification, illumination, &c. The choice and use of a microscope are treated of, and the mounting of objects for examination, with particulars of mounting materials, is also described.

"Ypres to Verdun": a collection of photographs of the war areas in France and Flanders, specially taken by Sir Alexander B. W. Kennedy, F.R.S. London: "Country Life," Ltd. Price 15s. net.—This work is a valuable addition to the existing pictorial records of the ravages of the great war, and is, in addition, a powerful argument against future wars. The photographs are excellent and well reproduced, and the notes, which are interspersed with them, are an admirable summary of the "human" touches which official histories lack, as well as providing a concise reivew of many of the principal actions.

"The Structure of the Atom," by Stephen Miall, B.Sc. (26 pp.). London: Benn Bros., Ltd. Price 1s. 6d. net.—This is stated to be a series of notes upon recent theories regarding the structure of matter. It reviews, briefly, the work of the numerous scientists who have devoted, and are devoting, particular attention to the subject. A non-mathematical style is adopted, and the little work aims to give students an idea of what has been done and of objects still to be achieved.

The *Bulletin* of the Hydro-Electric Power Commission of Ontario, February, 1922. Toronto: The Commission.—Included in this issue are articles on the Nipigon development; the effect of unloaded transformers on a system's power factor; kVA measurement and its effect on power factor; and notes on distribution in rural areas.

Registration of Business Names Act.—The Board of Trade, under the authority conferred upon them by the Registration of Business Names Act, 1916, have appointed Mr. Henry Birtles, the Registrar of Joint Stock Companies, and Mr. Arthur Edwin Campbell-Taylor, O.B.E., the Assistant Registrar of Joint Stock Companies, to be registrar and assistant registrar of business names respectively for the purposes of the aforesaid Act.

Telephone Wires and Cables for British Columbia.—H.M. Trade Commissioner for Western Canada (Mr. L. B. Beale) has recently been in communication with a company which maintains a telephone system in Western Canada, and has intimated to the Trade Commissioner that it is prepared to do business with firms in this country who can quote advantageous prices and delivery dates. Particulars of the telephone wire and lead-covered paper-insulated cable required by the company may be obtained at the Department of Overseas Trade (Room 49) in London. The company has been obtaining material from sources of supply in the North American Continent, and its readiness to purchase from the United Kingdom is not due to any dissatisfaction with existing connections. The import duty on telephone cable of United Kingdom manufacture is 20 per cent. ad valorem, as against 30 per cent. ad valorem in the case of United States manufacture, to which must be added in each case a sales tax of 4 per cent. of the duty paid value. In estimating the cost of delivering material in British Columbia, the advantages in the matter of cheap freight rates to be secured by shipment *via* the Panama Canal should not be lost sight of.

Italo-American Co-operation. — According to the *Elettricista*, there has recently been formed in Italy the Società Italo-Americana per la Elettrotrazione, of which seven of the most important power companies in Italy are members, as well as American firms, the object of the concern being the organisation of relations between Italian industrial firms and foreign firms, especially American, to promote the production and distribution of electricity and the construction and working of electric traction undertakings. It seems, says our contemporary, that the principal object of this company is the introduction into Italy of American systems of continuous current traction at high potential. Furthermore, a commission of technical experts has been sent to the United States to study on the spot this form of electrification.

Wage Reductions in New Zealand.—The Arbitration Court has delivered a verdict that weekly wages which, during the war and post-war periods, had been increased by bonuses to meet the increased cost of living, would be reduced by 5s. in the case of adult males, by 2s. 6d. for adult females, and 1s. 6d. for juniors. The representatives of the employers on the Court dissented from the Court's decision on the grounds that the deductions were insufficient, but the Court declared that any further reductions would entrench on the maintenance of a fair standard of living.—*Reuter* (Wellington).

Electricity Supply Rifle League.—The following are the results of matches shot during March and April:—City Co., 584, Central Co., 583; City Co., 582, County Co., 580; Metropolitan Co., 567, Hackney, 535; Metropolitan Co., 578, St. James', 564; Shoreditch, 586, St. James', 541; Central Co., 578, County Co., 576; Central Co., 577, Hackney, 536; City Co., 570, Metropolitan Co., 567; County Co., 577, St. James', 554; Shoreditch, 586, Metropolitan Co., 582.

West Midlands D.I.C.—We have received a copy of the second annual report of the No. 5 (West Midlands Area) District Industrial Council for the Electricity Supply Industry. In common with other district councils, steps were taken during the year to modify the application of standard working conditions to undertakings of 1,000-kW capacity or less, and a satisfactory settlement was arrived at. It was decided that members of the A.E.U. employed in electricity works should have their rates of pay regulated by the Council for the Engineering Industry. The Council approved, in principle, the model constitution of works committees formulated by the National Council, but was of the opinion that details should be left to the individual undertakings concerned. During the year a reduction in the demand for energy in the district necessitated the curtailment of working hours, but the Council reports that normal hours have now been resumed, with few exceptions. The financial statement is satisfactory, showing a credit balance of £11 14s.

A Dutch Company.—The report for 1921 of the Algem Nederl. Electriceits Mij. (late Groeneveld, Ruempool & Co.) states that there was a tendency for sale prices to advance at the beginning of the year, so that it was assumed that losses on the book value of the stocks would be out of the question. The contrary, however, proved to be the case, chiefly owing to the fact that Germany placed materials and machinery on the market at lower prices and in such a manner that many articles fell from 10 to 20 per cent. and more below the pre-war prices. During the year, and as a consequence of the continuing depression in industry, the inquiries and the normal orders for installation and repair works were considerably less than in the previous year. The final result for 1921 was a loss of 865,000 florins, which it is proposed to extinguish by writing down the share capital from 1,500,000 fl. to 375,000 fl.

Local Electrical Exhibition.—A Torquay electrical contractor, Mr. Sydney Truscott, recently arranged, with the assistance of the Corporation, an exhibition of domestic electrical appliances. The display was well arranged and comprehensive in nature. Among the exhibits were the "Tricity" cooker, the "Time-Saver" washing machine, the "Winsum" radiator, the "Genii-Neptune" radiator, the "Hoover" vacuum cleaner, "Tungar" rectifiers and transformers, "Vio-Ray" high-frequency sets, &c.

Publicity.—The RAWLPLUG Co., of Gloucester House, Cromwell Road, London, S.W.7, in pursuance of their established enterprising publicity policy, have continued their newspaper propaganda relating to "Rawlplugs" by taking the front page of a well-known London daily newspaper on May 25th.

Siberia.—According to a report by H.M. Consul at Vladivostock, a committee has recently been formed in Vladivostock for the purpose of rebuilding the town of Nikolaevsk-on-Amur, which was burnt down in 1920, and which is at present under Japanese administration, with a view to restoring the trade and industry of that district. The plans of the committee provide for the establishment of a town electric lighting station, a commercial port with wharves, warehouses, the installation of a telephone service, and many other works and premises. The committee invites the co-operation of British enterprise and capital in the work of reconstruction. Further details regarding the financing of the various undertakings and the terms of the different concessions may be obtained by interested British firms and commercial organisations on application to the Department of Overseas Trade, 35, Old Queen Street, S.W.1., quoting reference DOT/FR/5478.

Lead.—In their report dated May 13th, Messrs. James Forster & Co. say:—"Spot lead is very scarce, owing to delay in discharging at the docks. . . The Board of Trade Returns for April are: Imports, 14,180 tons, exports, 2,433 tons, leaving for home absorption 11,747 tons, making the latter figure for the first four months 47,591 tons—nearly 8,000 tons above the average for 1921. It is impossible to believe that this increase of about 20 per cent. is due to consumption. The production of sheets and pipe, although a little improved, is still round about 5,000 tons per month, a figure which corresponds with that of the average for last year; while it is certain that the electrical cables and accumulator trades are much less active than they were last year. The belief that much of the imports this year has gone into private stores seems to have a good deal of justification from the above figures."

Turkey's Delayed Recovery.—The recovery of Turkey is largely dependent upon the reconstruction of Southern Russia, particularly those districts which feed the Black Sea ports. Judging by the attitude of those who are making themselves heard at Genoa as the mouthpieces of Russia, any inclination on the part of merchants and capitalists to re-enter that country is likely to be baulked. Yet the fairly successful beginnings that Italy has made in resuming trade on a barter basis between Trieste and the Black Sea suggests that some revival at Constantinople may not be much longer delayed. In the first report on Turkey, printed by the Department of Overseas Trade after the Armistice, it was stated that the whole trend of events in Constantinople had been to carry on somehow in spite of disorganisation until the shortly-expected peace arrived. In the recent report by the Commercial Secretary at Constantinople it is remarked that this is now nearly three years ago, and the end seems no nearer in sight. It is true that the remarkable facility that the Turkish public seems to possess in some way to get over one crisis after another finds the town in certain respects perhaps in a slightly better position at the beginning of 1922. There is no doubt, as regards Anatolia, that, given internal peace and a stable Government, people would be prepared to invest money in the exploitation of its rich resources, even where before the war the risk was great. The solvency of the country, however, is bound up with the Anatolian question. Turkey has a heavy bill of expenses to pay, and this is growing larger each day with the continual Allied occupation, and until both this country and Russia are once more at peace, it is not likely that this market will afford much attraction for foreign trade.

We have received a copy of the report of the British Chamber of Commerce of Turkey for 1921. During that year 122 members were admitted, this being the second largest number elected in any one year since the Chamber was established, as compared with 175 during 1920, which was the record year. This result would be satisfactory were it not for the fact that resignations "and the disappearance of a number of firms of mushroom growth" have resulted in a net increase of only 43 to the end of December, 1921.

Netherlands.—H.M. Consul-General at Antwerp reports to the Department of Overseas Trade in London that the Municipal Council of Den Ham (province of Overijsel) has decided to proceed with the electrification of Den Ham and Vroomshoop, for which purpose a loan of Gld. 115,000 will be issued.

Electrification in Russia.—The Russian Trade Delegation learns from Moscow that the Government is considering a Bill to authorise the establishment of local electrification corporations, comprising public bodies and private individuals, to obtain local concessions for the exploitation of electricity for from 5 to 50 years.—*Reuter's Trade Service.*

The Paris Fair.—The Paris correspondent of the *Morning Post* states that there are 4,500 exhibitors at the Fair. From the industrial point of view the most interesting feature is probably the section devoted to agricultural machinery. The engineering section is notable for its electrical display, and for its demonstration of high-grade machine tools.

Our Foreign Trade.—April Figures.—The following were the values of imports and exports of electrical goods and machinery during April, 1922:—

	April, 1922.	Inc. or dec.	4 months, 1922. Inc. or dec.
Imports:—	£	£	£
Electrical goods and apparatus	100,530	−110,473	−479,098
Machinery	652,283	−376,495	−2,554,356
Exports:—			
Electrical goods and apparatus	594,091	−842,018	−2,375,992
Machinery	4,280,354	−3,503,948	−8,943,463
Re-exports:—			
Electrical goods and apparatus	33,862	+8,682	−30,992
Machinery	94,434	−371	−70,326

Works Welfare.—At Messrs. Dick, Kerr's canteen, Preston, on May 9th, a team of girl employés of the English Electric Co. gave a programme of physical exercises and folk dancing before Miss Orme, of Coventry, judge in a competition for girls, in connection with the firm's welfare scheme.

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries. Firms desiring to enter an objection to any of the applications have one month in which to do so from the dates given below. In the case of foreign firms, the name of the representative in this country to whom notice of objection should be sent is also given:—

Newking. No. 416,978. Class 13. Electrical contacts.—George Herbert (Handsworth), Ltd., 14, St. Mary's Row, Birmingham. May 10th, 1922.

J.E. (lettering and design). No. 423,863. Class 16. Porcelain and earthenware.—The Jeary Electrical Co., Ltd., 8, Lambeth Hill, E.C. May 10th, 1922.

Lucas. No. 419,973. Class 18. Electric lighting equipments for cycles and motor vehicles.—Joseph Lucas, Ltd., Great King Street, Birmingham. May 10th, 1922.

Helsby. No. 419,277. Class 8. Electric cables.—The British Insulated & Helsby Cables, Ltd., Prescot. May 10th, 1922.

Prescot. No. 419,278. Class 8. Electric cables.—The British Insulated & Helsby Cables, Ltd., Prescot, Lancs. May 10th, 1922.

Autoskop. No. 421,144. Class 13. Electric spark indicating devices.—Sophus K. Olsen, trading as L. Poulsen & Co., 11, Nyharn, Copenhagen, Denmark (A. S. Cachemaille, 2, Norfolk Street, London, W.C.). May 10th, 1922.

Owl (design). No. 416,584. Class 13. Electric horns and alarms for use with motor vehicles.—Thos. S. Rogers, 25, Edmund Road, Alma Rock, Birmingham. May 10th, 1922.

New Belgian Company.—La Société de l'Usine Hydro-electrolytique du Samson is the name of a new company which has lately been formed at Samson-Maizeret (Province of Namur), with a capital of 1,000,000 fr., for the purpose of generating and distributing electrical energy and also for the manufacture of accumulators and electrical apparatus.

Wild-Barfield Furnaces.—Automatic and Electric Furnaces, Ltd., informs us that it has introduced a marine type of Wild-Barfield electric furnace for use on board ship. This has been examined by Admiralty experts and passed for installation in H.M. ships.

LIGHTING AND POWER NOTES.

Aberdeen.—The arbiter in the dispute between the Corporation Electricity Department and Mr. Wm. Tawse, contractor, regarding the operations for supplying water from the River Dee for condensing purposes in connection with the extensions at the electricity station, has given his decision, which is understood to be in the nature of a compromise between the parties, each to pay its own expenses and half the arbiter's fees. The Corporation has also to appoint a civil engineer to take charge of the work, which will be resumed forthwith.

Barnes.—Profit and Price Reductions.—There was a profit of £2,500 on the working of the electricity undertaking for the past year, and the Council is reducing the charge for electricity by 1d. per unit for lighting and ¼d. for power and heating.

Mains Extensions.—During the present financial year a sum of £4,463 is to be expended on extensions of mains and services. £3,500 is to be charged to capital account and the remainder to revenue account.

Barnsley.—Price Reductions.—The Electricity Committee has recommended that the following reductions be made in the charges for electricity:—Lighting, from 8d. to 7d. per unit; public lighting, from 2½d. to 2¼d.; flat rate consumers by ¼d.; and for heating and cooking, from 2d. to 1½d.

Bedwellty.—Loan.—Application is to be made to the Electricity Commissioners for sanction to the borrowing of £10,000 for the erection of sub-stations, laying of cables, &c.

Bexhill.—Year's Working.—The report of the borough accountant on the electricity undertaking for the year ended March last records a gross profit for the year of £10,145, an increase of £2,685 on the previous year. The working costs have increased by £1,723, while the income has risen by £4,407. After making provision for repayment of loans, income tax, &c., there remains a net profit on the year's working of £2,122, as compared with £639 in the previous year.

Corwen.—Electricity Supply.—A limited company has been formed to carry out a hydro-electric scheme for the town. Electricity will be generated at the Cynwyd waterfalls, about two miles away, where two turbines will be installed.

Croydon.—Application for Order.—The Town Council has applied for an Order to enable it to supply electricity to Addington, which is outside the borough. The cost of the proposed extension is about £1,000. Owing to the increase in the demand for electricity, £12,084 is to be expended on additional plant.

Exmouth.—Application for New Order.—The Electric Supply Corporation is applying to the Electricity Commissioners for an Order rescinding the Exmouth Electric Lighting Order, 1900, and granting to the Corporation in lieu a new Order authorising the supply of electricity in the urban district of Exmouth.

Farnham.—Inquiry.—An inquiry is to be made by the Electricity Commissioners into an application by the Gas and Electricity Co. for the price of electricity to be increased. The present charge for lighting is 9d. per unit, and under the present application the minimum charge is to be altered from £2 13s. 4d. to £2 10s. per annum, with the minimum number of units chargeable per annum reduced from 60 to 50. The Urban District Council has decided to oppose the application.

Greenlaw.—Electricity Supply.—The Berwickshire County Council has granted permission to the Greenlaw Electric Supply Co. to erect overhead lines in the town for the transmission of electricity.

Henley-on-Thames.—Electricity Supply.—At a meeting of the Town Council last week, a deputation from the Reading Electric Supply Co., Ltd., attended, and the managing director explained a projected scheme for supplying electricity to the town and adjacent parishes. It was stated that for Henley the charge for lighting would not be above 1s. per unit; for heating 3d. per unit for the first 1,000 units and 2½d. above that amount; and for power 4d. per unit up to 5,000 and 3½d. for each additional unit.

Heywood.—Year's Working.—There was a loss of £1,047 on the working of the electricity undertaking during the past year.

Hitchin.—Special Order.—The Electric Supply Corporation is applying to the Electricity Commissioners for an order rescinding the Hitchin Electric Lighting Order, 1902, and granting to the Corporation a new Order authorising the supply of electricity in the urban district of Hitchin.

Lerwick.—Electricity Supply.—It is proposed to form a private company to light the town with electricity. Mr. C. Thomson has approached the Town Council on the subject.

Leyton.—Loan Sanctioned.—The Electricity Commissioners have sanctioned the borrowing of £27,500 for the erection of a sub-station at the junction of Church and Waterloo Roads.

Liverpool.—Loan Sanctioned.—The Electricity Commissioners have sanctioned the borrowing of £50,000 for mains.

Menai Bridge.—Purchase of Undertaking.—At a recent meeting of the Council it was decided to purchase the local electricity undertaking.

Middleton.—Electricity Supply.—Arrangements have been made to obtain a supply of electricity from the Manchester undertaking, and the Corporation is to lay a 33,000-V cable from the Manchester boundary at Blackley to the electricity works in the borough, which, together with the installation of sub-station plant to enable an increased bulk supply to be obtained, will cost £33,000. It is intended at a later date to lay a cable from Middleton to the Failsworth boundary of Manchester, so that in the event of the supply *via* Blackley failing it will be possible to obtain a supply by means of the Failsworth cable.

Milnrow.—Loan.—The Urban District Council has decided to apply to the Electricity Commissioners for sanction to a loan for carrying out extensions in connection with the electricity undertaking.

Pontypridd.—Extension of Supply.—The Town Council has decided to extend its mains to Trehafod at an estimated cost of £1,029.

Portsmouth.—Extension of Area of Supply.—The Corporation has applied to the Electricity Commissioners for authority to extend its area of supply to include the urban districts of Havant and Warblington, and the rural district of Havant, and to provide and distribute electrical energy for all purposes with the added districts.

Loan Sanctioned.—The Town Council has received sanction to a loan of £3,000 for extensions to the engine house at the electricity works.

Skelton and Brotton.—Reduced Charges.—The Urban District Council has reduced the charges for electricity for lighting from 6d. to 5½d. per unit, and for power, cooking, and heating purposes from 2½d. to 2¼d. per unit.

South Africa.—Government Proposals.—The Cape Town correspondent of *The Times* says that the Government has introduced an electricity Bill providing for the appointment of a Commission for establishing and maintaining stations for the supply of electricity to Government and local authorities, companies, and individuals, also for an investigation regarding additional supplies and the co-ordination of existing undertakings with a view to stimulating the provision of a cheap and abundant supply of electricity. Except in the case of municipalities the Commission will be empowered under the Bill to fix prices and order a return to consumers of 25 per cent. of the surplus profits. After 38 years the Government may give two years' notice of its intention to expropriate all but municipal electrical undertakings, paying nothing for goodwill or prospective profits.

Sunderland.—Reduced Charges.—The Town Council has authorised the following reduced scale of charges for electricity for heating and cooking purposes, in place of the flat rate of 2½d. per unit:—Not exceeding 500 units per quarter, 2½d. per unit; 500-1,000 units, 2¼d.; 1,000-1,500 units, 2d. per unit; 1,500-2,500 units, 1¾d.; exceeding 2,500 units per quarter, 1½d.

Wallasey.—Loan Sanctioned.—The Town Council has received sanction from the Electricity Commissioners to a loan of £7,900 for electricity purposes.

Warminster.—Extension of Supply.—The Electric Light Co. has acquired an old foundry near the Market Place for use as a generating station, and arrangements have been made for the mains to be extended to the village of Sutton Veney, and it is hoped to have electricity available by Christmas.

Warwick.—Street Lighting.—The Town Council has accepted the tender of the Leamington and Warwick Electric Supply Co. for lighting the streets in a portion of the area by electricity.

Chichester.—Special Order.—The Corporation is applying for a Special Order under the Electricity (Supply) Acts, to supply electricity within the districts of Appledram, Birdham, Donnington, Earnley, East Wittering, Hunston, Lavant, Merston, New Fishbourne, North Mundham, Oving, Selsey, Sidlesham, Westhampnett, West Itchenor, and West Wittering.

Worksop.—Electricity in Bulk.—Negotiations are in progress between the Urban District Council and the Rotherham Corporation for a bulk supply of electricity.

TRAMWAY AND RAILWAY NOTES.

Accrington.—Year's Working.—There was a profit on the tramway undertaking for the past year of £5,300, as compared with a loss of £2,008 for the previous year.

Barrow.—Reduced Fares.—The Town Council has sanctioned the introduction of penny fares and new stages on the tramways.

Burnley.—Track Renewals.—Application is to be made by the Town Council to borrow £40,500 for renewal of the tramway track on Padiham Road, Manchester Road, and Rosegrove routes.

Chile.—Railway Electrification.—Sir Robt. Harvey, chairman of the Nitrate Railways Co., Ltd., last week said that the late chairman spent several months in the Chilean capital early last year, and, after prolonged negotiations, he agreed with the Chilean Government upon a programme of electrification and other improvements, and two decrees were issued by the Government covering those arrangements. Unfortunately, however, when these decrees came before Parliament, the Chilean Congress withheld ratification. The decree for the extension of the company's concessions had been annulled. They had presented a further petition to the Chilean Government relating to the decree for extension of concessions, setting out again the arguments contained in their original petition, and emphasising the fact that without such extension they could not obtain and amortise the necessary capital for electrification and other improvements.

Although they were disappointed that so far their decrees remained *in statu quo*, they were so confident that this scheme of electrification and improvements would be to the interests of the nitrate industry, and therefore to the country generally, that they had every hope of an early and favourable decision. Their friends, the Nitrate Producers, had realised that an increase in tariffs was justified, and that the electrification of their bank section would make so much more easy the solution of the traffic problem that they were giving them their benevolent support with the Chilean Government.

Continental.—Spain.—A concession has been granted to the Sociedad Anonima Ferrocarril Metropolitano de Barcelona for the construction and working of an underground electric railway to link the Barcelona-Tarragona and the Barcelona-France railways in Barcelona. The scheme will cost 710,784 pesetas. The work will be begun within two or three months, and it is hoped to complete it within six years.

Application for a concession to construct an electric tramway in Seville has been applied for by the Compania Tranvia de Sevilla.

Germany.—An outlay of 111,000,000 marks has been partially voted for the electrification of the railway lines in Bavaria comprised in the Garmischer and Holzkirchner group, which are dependent on the great station now being built on the Walcheren See. This station is expected to be completed by the end of 1923. A 100,000-V supply network will be constructed to embrace some 14 towns; on the completion of this, further extensions will be made from Pasing, Middle Isar Landschaft to Regensburg

Halifax.—Accident.—A Corporation electric tramcar was considerably damaged in a collision, last week, with a motor lorry coming from a side road at West Vale. The front of the tramcar was forced from the rails, the driving platform was smashed in, and the brake wheels and steering gear were buckled. The driver escaped without injury.

Heywood.—Year's Working.—Last year's working of the tramways resulted in a loss of £2,431.

Hull.—Order Refused.—The Ministry of Transport has declined to grant the Corporation a Light Railway Order to enable it to run electric tramcars to Hessle. There was considerable opposition to the application, especially from the North-Eastern Railway and the proprietors of motor-omnibuses.

Leeds.—Year's Working.—The annual report of the general manager of the Tramways Department (Mr. J. B. Hamilton) for the year ended March 31st, 1922, shows a total income of £959,703, as compared with £995,638 in the previous year. Working expenses amounted to £702,250 (£729,345), leaving a gross profit of £257,453, to which is added £177, bank interest, giving a total of £257,630. Loan charges, income tax, &c., absorbed £162,786, leaving a balance of £94,844. As, however, the net cost of permanent way renewals amounted to £138,110, there was a net deficit for the year of £43,266, as against £5,622 profit in 1920-21. This is the first year in which the undertaking has shown a deficit.

The report on the railless traction undertaking shows a total revenue of £13,345, as compared with £13,564 in the previous year. Working expenses amounted to £11,937 (£11,604), leaving a gross profit of £1,408; income tax and loan charges absorbed £2,054, leaving a net deficit of £646. There was a loss of £347 in the previous year.

London.—Accident.—Two tramcars came into collision at the corner of Dalston Lane and Amhurst Road just before midnight last Saturday. Whilst turning a corner near Dalston Lane the lights on one of the tramcars went out, and the car following ran into it at considerable speed. Eight passengers were severely injured.

Plymouth.—Year's Working.—The working of the tramway undertaking for the past year shows a profit of £7,000.

TELEGRAPH AND TELEPHONE NOTES.

Hull.—Municipal Telephones.—At a recent meeting of the Corporation Telephones Committee it was stated that even allowing for the reductions being made by the Post Office for telephone service, the Hull subscribers were saving from £16,000 to £20,000 a year as compared with the Government charges. There was a profit of nearly £4,000 for the year ended March 31st last, after paying £10,000 in royalties to the State. The total paid in royalties since the inauguration of the service is £74,000. The system has between 12,000 and 13,000 subscribers.

Pacific Cable.—Proposed Duplication.—Mr. Milward, of the Pacific Cable Board, who is now in Fiji inquiring in connection with the duplication of the Pacific cable, is going to London to meet the directors in June, when a decision on the project is expected. He estimates the cost at £2,000,000, with work occupying two years.—*Daily Mail.*

The Telephone Service.—New Developments.—The Post Office announced, on May 10th, some details regarding the expenditure of 9½ million pounds upon the improvement and extension of the telephone service. It is proposed to open twelve new exchanges at the following places in the London area:—Monument (S.E.), Barnet, Tottenham, Eltham, Kilburn, Southall, Hounslow, Nunhead, Woodford, Wallington, Addiscombe, and Thornton Heath.

In the provinces nine new exchanges are to be installed, namely, at Eastbourne, Southampton, Swansea, Birmingham, Sheffield, Buxton, Liverpool, Inverness, and Dundee.

Automatic systems are to be introduced into Gloucester, Swansea, Sheffield, Shrewsbury, Dundee, and Kirkcaldy, while new automatic exchanges are to be installed at Southampton and Fleetwood, where the system is already working.

United States.—Wireless on a Train.—The Southern Pacific Railroad Co. has had installed on one of its trains a radio receiving set to receive the broadcasting of concerts, &c. The first trial, which took place on April 9th, was quite successful. The aerial consisted of forty feet of two-strand antenna 14 in. above the roof of the car. The two strands were tapped at the centre of the car, and the taps joined inside of the car and connected to the receiving instruments. The receiving set consisted of a two-step "Magnavox" audio frequency power amplifier, a type "R 2 Magnavox" amplifying horn, and a Western Electric two-step amplifier and detector, a 200-V "B" battery and 6-V filament battery. Four wires were laid on the cement floor of the car under the carpet and brought to one common terminal at the set.—*Telegraph and Telephone Age.*

Wireless Telegraphy.—On Friday night last damage to the amount of between £20,000 and £30,000 was done to the British naval wireless station at Bunbeg, Co. Donegal. A few weeks ago a party of the I.R.A. mutineers took possession of the station, and, having used it for various purposes, last week they sold the fittings and furniture and set the place on fire. The extensive mansion-house, naval and military quarters, and the wireless portion of the building—all of which had been put up during the war—were burned.

Wireless Telephony.—The *T. & T. Age* credits Maior-General G. O. Squier with the invention of a new development in wireless telephony by which speech can be received by attaching the usual receiving set to an electric lighting circuit and eliminating the antennæ. The whole operation, it is stated, consists of removing a lamp from its holder and plugging in the receiver of the radio set.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Aberdare.—Urban District Council Electricity Department. Second-hand 500/700-kW Belliss or other a.c. steam generating set. (May 5th.)

Powell Duffryn Steam Coal Co., Ltd. Copper wire and electrical accessories for three or six months. Stores manager, Aberaman Offices, Aberdare.

Aberdeen.—May 22nd. Electricity Department. Structural steelwork, corrugated iron sheeting, &c., for the new boiler-house at Ferryhill. (May 5th.)

Argentina.—Buenos Aires.—June 28th. Argentine Board of Sanitary Works. Hydro-electric generating station and transforming sub-station for the town of Catamarca:—Three 165-h.p. Pelton wheels, three 110-kW three-phase alternators, switchboard, two 20-kVA three-phase static transformers, piping, valves, and accessories, spares, &c.; two 130-kW motor-generators, with switchboard and spares.*

Buenos Aires Waterworks.—Machinery for three pumping stations, one power station, and eight transforming sub-stations. Copy of the specifications and conditions of tender (in Spanish), with blue prints, can be seen at the Department of Trade, 35, Old Queen Street, E.C. (Room 49), up to June 10th.*

Australia.—Melbourne.—September 1st. Electricity Commission. Five surface feed water heaters, six surface vapour condensers, 12 feed-water evaporators. (See this issue.)

October 17th. Postmaster-General's Department. Supply of automatic switchboards and associated apparatus for two suburban exchanges at Melbourne.

June 20th. Postmaster-General's Department. 420½ tons bronze wire (sched. 28), 400 tons galvanised iron wire (sched. 32), 47 tons galvanised steel wire (sched. 32), 413,400 jointing sleeves (sched. 33). (See this issue.)

June 7th. Victorian Railways. Supply and delivery of 7,190 steel rails (60 lb.); 7,390 fishplates.*

Queensland (Bowen).—June 30th. Municipal Council. Electric power generating plant, switchboard and other equipment.

Belgium.—St. Gillos (Brussels).—May 23rd. Municipal Council. Armoured cable, &c.*

May 22nd. Municipal Authorities of Antwerp. Construction of a higher technical elementary school. The estimated cost is 248,000 fr., and electrical firms interested can see a copy of the specification (in French) at the Department of Overseas Trade (Room 41), 35, Old Queen Street, London, S.W.1. (Ref. 15500/FW/PN.)

Dorchester.—May 24th. Electricity Department. One vertical gas engine direct coupled to a 1,000-kW d.c. generator, with gas producer plant, pipework, auxiliaries, &c. (May 5th.)

Dundalk.—May 23rd. Electricity Department. One 340-kW Diesel generator, one 100-kW motor-generator, one 50-kW balancer, switchgear, &c.; replating 500-V storage battery. (May 5th.)

France.—Nerac, Departement Lot et Garonne.—May 25th. Municipal Council. Material and installation for an electrical distribution network at Nerac.

Glasgow.—The Education authority invites tenders for installing electric light in a number of schools. Schedules from Property Department, 129, Bath Street, Glasgow.

Greenlaw (Berwick).—Parish Council. Wiring Town Hall for electric lighting installation, also street lighting. Mr. D. Leitch, clerk, Parish Council offices, Greenlaw, Berwickshire.

India.—May 26th. High Commissioner's Department. Insulator cups, porcelain or glass. (May 5th.)

June 9th. High Commissioner's Department. Copper telegraph wire, Carsack elements for Leclanché cells, v.i.r. insulated cable. (See this issue.)

Italy.—July 31st. The State Railways announce that the period for the reception of tenders for the electrification of the Bologna-Venice-Monfalcone line, fixed previously for April 30th, 1922, has been extended until July 31st, 1922.

Kirkcaldy.—June 5th. Electricity works. Steam turbine, three-phase alternator, condensing plant and piping. (May 12th.)

London.—Hackney.—June 14th. Electricity Committee. Pipework and valves. (May 5th.)

Islington.—May 27th. Board of Guardians. Electric light and power installation at the Institution, &c., St. John's Road, Holloway. (See this issue.)

Stepney.—June 8th. Electricity Supply Department. Three water-tube boilers, with chimneys, economisers, and accessories; two 10,000-kW turbo-alternators with condensers, accessories, and switchgear. (May 5th.)

Manchester.—May 23rd. Electricity Committee. Electrical storage batteries, for Barton power station. One 120-cell battery, capacity 600 amp. for one hour; one 120-cell battery, capacity 300 amp.-hours at the 10-hr. rate. (May 5th.)

New Zealand.—Wellington.—July 4th. Department of Public Works. Three 1,320-kVA single-phase transformers, with accessories.*

Nottingham.—June 9th. Electricity Department. North Wilford power station. Six steel-tube fuel economisers, four steel chimneys, six induced draught fans, &c.; e.h.p. main switchgear, e.h.p. and l.p. auxiliary switchgear, cable connections, &c.; three 30-in., one 10-in., and three 3-in. electrically-driven centrifugal pumps; one 75-ton overhead travelling electric crane, one 10-ton and one 5-ton overhead travelling hand crane, &c.; two 750-kW rotary converters, one 35-kW motor generator-booster, &c. (May 12th.)

Preston.—June 24th. Electricity Department. Boilers, stokers, economisers, fans, chimneys, feed piping, and feed pumps. (May 12th.)

Rhondda.—June 6th. Electricity Committee. Sub-station, e.h.p. and l.p. switchgear. (See this issue.)

Siam.—Bangkok.—June 28th. Department of Posts and Telegraphs. Telegraph and telephone material, including wire, cable, wall telephones, &c.*

South Africa.—Frankfort, Orange Free State.—The Municipality is inviting tenders for a hydro-electric scheme. Particulars from the consulting engineer, Mr. W. Ingham, 101, Consolidated Buildings, Fox Street, Johannesburg.

Grahamstown, Cape Province.—September 1st. Power plant, alternators, switchboard, transformers, cables, &c. Specifications from Mr. F. G. Clarkson, town clerk.*

Sunderland.—June 1st. Tramways Department. 150 tons of steel tramway rails. General manager.

Warrington.—May 30th. Cheshire Lines Committee. Six months' supply of stores and materials, including telegraph materials. Stores Superintendent, Cheshire Lines, Warrington.

*A copy of the plan, specifications, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Australia.—Melbourne.—Electricity Supply Committee. Accepted:—

Copper bars, £153; 25 tons bare h.d. copper cable, £3,367.—British Insulated & Helsby Cables, Ltd.

Sydney.—Electricity Committee. Recommended:—

5-amp. meters (£3,187).—Electricity Meter Manufacturing Co.—*Tenders.*

Cardiff.—Electricity Committee. Accepted:—

Erection of bunkers and boiler-house roof, Roath power station.—John Booth & Sons, Ltd., Hulton Steelworks, Bolton.

Farnborough.—Urban Council. Accepted:—

Installing the electric light in the large hall at the Town Hall.—Burch and Vertue.

Glasgow.—Corporation. Accepted:—

Alterations to electric lighting at Corporation district libraries (£52).—Johnston, Park & Co.

Corporation. Tramways Committee. Recommended:—

H.p. switchgear for Whitevale sub-station.—Metropolitan-Vickers Electrical Co., Ltd.

Spare resistance for electric welding plant.—The Electro-Mechanical Brake Co., Ltd.

Steam piping for 10,000-kW turbo-alternator.—John Spencer, Ltd.

Tramway poles.—Stewarts & Lloyds, Ltd.

Sub-Committee on Works and Stores. Recommended:—

Electrical materials required by the departments during the next six months.—General Electric Co., Ltd.

India.—JUBBULPORE.—The contract for the installation of plant, wiring, and other equipment for the lighting of the Cantonment, the city and suburbs has been placed with the Metropolitan-Vickers Electrical Co., Ltd. It is expected that the work will take between two and three years.—*Indian Engineering.*

Portsmouth.—Town Council.

Cables (£483).—Pirelli-General Cable Works, Ltd.
Cable (£32).—Johnson & Phillips, Ltd.
Steelwork for new engine-house roof (£145).—Braithwaite & Co.
Circulating pump (£970) and three feed pumps (£185 each).—G. & J. Weir, Ltd.

Weymouth.—Town Council. Accepted:—

Commutator for the turbo-generator (£195).—Brush Electrical Engineering Co., Ltd.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, May 19th. At Caxton Hall, S.W. At 8 p.m. Lecturette, "Engineering Business in China," by Mr. F. W. G. Clark.
Friday, May 26th. At 8 p.m. Lecturette, "Engineering Appointments and How to Get Them," by Mr. J. C. Rennie.

Institute of Physics.—Tuesday, May 23rd. At Burlington House, Piccadilly, W. At 5 p.m. Annual general meeting. Presidential address by Sir J. J. Thomson, F.R.S.

Royal Society of Arts.—Wednesday, May 24th. At John Street, Adelphi, W.C. At 8 p.m. Paper on "The Natural Power Resources of Ireland (Coal, Peat, Water Power)," by Mr. G. Fletcher, Department of Agriculture and Technical Instruction for Ireland.

Institution of Electrical Engineers.—Thursday, May 25th. At the Institution, Victoria Embankment, S.W. At 6 p.m. Annual general meeting. The annual general meeting of the Benevolent Fund will be held at 5.45 p.m.

Illuminating Engineering Society.—Thursday, May 25th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 8 p.m. Annual meeting. Presidential address by Sir J. H. Parsons, F.R.S.

National Association of Supervising Electricians.—Thursday, May 25th. At 2 p.m. Visit to the Osram Works of the General Electric Co., Ltd.

Physical Society of London.—Friday, May 26th. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Lecture on "Atomic Weights and Isotopes," by Dr. F. W. Aston, F.R.S.

Royal Institution of Great Britain.—Friday, May 26th. At Albemarle Street, W. At 9 p.m. Lecture on "The Internal-combustion Engine, its Influence and its Problems," by Prof. W. E. Dalby.
Saturday, May 20th. At 3 p.m. Lecture on "The Disappearing Gap Between the X-ray and Ultra-Violet Spectra"; (ii.) "Photo-Electric Methods," by Prof. O. W. Richardson, F.R.S.

Association of Engineers-in-Charge.—Saturday, May 27th. At the Holborn Restaurant (Venetian Chamber). At 6 for 6.30 p.m. Twenty-second annual dinner.

Electricity District Inquiry.—Tuesday, May 30th. At the Middlesex Guildhall, Westminster, S.W. At 10.30 a.m. Inquiry by the Electricity Commissioners into the applications of the South-Eastern & Chatham Railway Co.'s Managing Committee and the West Kent Electric Co., Ltd., for consent to the establishment of power stations at Charlton and Belvedere respectively.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

WE continue to receive many inquiries without the necessary stamped addressed envelope for reply. We would, therefore, once again remind inquirers of the simple rules of the Service Department:—

1. Address your inquiries to the ELECTRICAL REVIEW, LTD., Service Department, *and enclose a stamped addressed envelope.*
2. Do not ask for information until you have satisfied yourself that it is not already contained in our advertisement pages.
3. If we are the means of putting you in touch with the firm or firms that you require, do us the favour of mentioning the ELECTRICAL REVIEW.

No charge is made for the service.

To complete our answers this week we need the names of suppliers or manufacturers of:—

Millington & Miller, Lamp Shade Remover.
An electrical device for locating iron pipes in the ground.
Hecla irons and heating apparatus (Swiss).

NOTES.

The Lock-out.—According to the various newspaper reports of yesterday morning, the revised proposals of the employers were before the conference on Wednesday, and were favourably viewed by the union representatives, who regarded them as more satisfactory than previous proposals and likely to afford a basis of settlement. The following agreed statement was issued on Wednesday night:—

"The union representatives have been in negotiation with the employers, and have considered the proposals submitted for their consideration by the employers. Further questions were addressed to the employers and answers received, and the conference stands adjourned until to-morrow morning. The union representatives will meet separately at 10 o'clock and will meet the employers in joint conference later."

A Journal of Scientific Instruments.—The Institute of Physics, impressed with the need of a journal dealing with methods of measurement and the construction and use of instruments, has under consideration the publication of a journal bearing the above title. In Germany there are some four or five journals which cover this field, and one of these, which devotes itself entirely to the subject of scientific instruments, has been of great influence in imparting a sense of the importance of scientific methods in the study of technical and industrial problems. Incidentally, it has been largely instrumental in fostering the scientific instrument trade of the country.

Research workers and manufacturers in this country have long felt the need of such a journal, for although descriptions of instruments and methods of measurement are published in the specialised journals and in the *Transactions* of learned societies, emphasis is not, as a rule, laid on the construction of the instruments, nor are detailed drawings generally reproduced. Still less does one find an indication of possible applications of an instrument or method in a field other than that for which it was originally devised. Physical measurement is the basis of all exact scientific and industrial work, and a journal of the proposed scope will not only be of direct value to the research worker in physics, chemistry, engineering, biology and medicine, but it will also materially aid manufacturers of scientific instruments and act as an incentive to invention and progress.

The journal will be managed by a committee appointed by the Institute of Physics, on which the Department of Scientific and Industrial Research and the National Physical Laboratory will be represented, and the editorial work will be carried out at the National Physical Laboratory, assisted by a scientific advisory committee appointed by the Institute of Physics. It will probably consist of 32 pages, and will be published monthly at 2s. 6d. per issue. The Institute will only find it possible to make itself responsible for the journal if its financial position is secured, and as a means of ascertaining what support may be expected a specimen number is now being issued *gratis*. Anyone desirous of obtaining a copy of this number is asked to apply to the Secretary of the Institute of Physics, 10, Essex Street, London, W.C.2, and to enclose 6d. to cover postage.

Appointment Vacant.—Tramways manager (£400), for the Keighley Corporation tramways. (See our advertisement pages to-day.)

Service Notes.—Lieutenant J. M. Howson has been posted to the battleship *Courageous* as flag-lieutenant to Rear-Admiral E. Hyde Parker and as signalling and wireless officer to the Reserve Fleet, from the 15th inst. Lieutenant Howson was formerly serving in the same capacity on the battleship *Conqueror*. Lieutenant B. R. Willett, D.S.C., has been similarly posted to the battleship *Revenge* as signalling and wireless officer to Rear-Admiral A. A. M. Duff. He won the Distinguished Service Cross during the fighting in the North Sea in 1915. Latterly he was at the Naval College. Lieutenant W. S. Mann has joined the staff of the battleship *Revenge* for wireless duties.

"Anti-Dazzle" Lamps.—Mr. J. W. T. Walsh, of the National Physical Laboratory, lecturing before the Optical Society, on May 11th, on the problem of glare from motor-car headlights, said that about 2,000 devices had either been put on the market or suggested in the last five years, with the object of giving the lamp beam the required distribution to eliminate glare, but the problem was still awaiting solution. Owing to the increasing number of accidents attributable to it, the matter was one of continually greater urgency. In the United States the problem had been dealt with by confining the main part of the beam to the region below the horizontal. Fifteen States (including New York and Ohio) had put a limit to the candle-power above the horizontal, 35 States imposed a maximum candle-power of beam, and 19 States specified a maximum candle-power varying from 21 to 32 for the lamp inside the projector. The only devices worth considering were those which aimed at re-distributing the light in the beam. Mr. Walsh emphasised the desirability of uniformity of "anti-dazzle" legislation throughout the world, and mentioned that the International Commission on Illumination had appointed a special commission to secure this object.—*The Times.*

Brakes for Tramcars.—Mr. J. W. Dawson, assistant tramway engineer to the Bradford Corporation, lectured before the Yorkshire Association of Civil Engineers, at Bradford Technical College, on May 8th, on "Brakes for Tramway and Road Vehicles." Professor G. F. Charnock, president of the Association, occupied the chair, and commented on the large percentage of tramway accidents which were found to be due to defective brakes, and remarked that every passenger who caused an electric car to be stopped for him to enter or alight was responsible for an expenditure of energy which would carry him nine miles. It had been ascertained that in several large cities the stopping and starting of cars cost in energy as much as £50,000 in a year. The lecturer referred very largely to the electric tramway braking system in Bradford, where, owing to the hilly nature of the routes, it was a most important factor. The Bradford cars were fitted with three brakes. The track brake was applied to such an extent as practically to balance the effect of gravity pull on the car on any gradient; the electric brake was in such a position that in the event of a car exceeding eight or nine miles per hour the brake would come into operation and limit the speed; and the hand-brake provided general control of the car.

A 1,000,000-volt Transformer.—We reproduce from the *Westinghouse International* some particulars and illustrations of the 1,000,000-V, 1,000-kVA transformer made by the Westinghouse Co., to which previous reference has been made in our pages. The windings of this transformer, seen in fig. 1, contain nearly 70 miles of wire, and are assembled on the principle of a condenser bushing. The transformer is divided into a number of cylindrical coils, each consisting of one layer of turns wound on a micarta tube. The two sets of windings are cross-connected so as to produce a progressively increasing

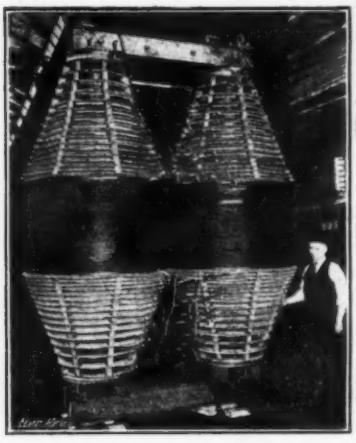


FIG. 1.—THE WINDINGS OF THE 1,000,000-V TRANSFORMER.

FIG. 2.—THE 1,000,000-V TRANSFORMER INSTALLED.

voltage from the inner, or smallest diameter, coils to the larger diameter coils. The windings of these large coils consist of treated cloth-covered cable to withstand the heavy surges produced when the apparatus under test flashes over. Fig. 2 shows the completed installation. The terminal bushing is 19 ft. in length, 41.5 in. in diameter, and weighs 9,000 lb. The static shield is 10 ft. in diameter and 20 in. deep. From the dimensions given, and from the comparison provided by the man appearing in fig. 1, a good idea of the size of this transformer may be gained.

Fatality.—On May 5th the inquest was resumed on William Bacon, of Sutton-in-Ashfield, who was killed while working a coal-cutting machine at Silver Hill Colliery. William Smith, who was working with deceased, stated that on April 27th it was found that the controller into which the coal-cutter was plugged was damaged, and so a new one was fitted. Witness plugged into this and received a severe shock. He was assisted to his feet, and it was found that Bacon, who was several yards away, was lying on his face, dead. The electrician in charge stated that he tested the machine and found it in order, except for a leakage due to the faulty insulation of the earth wire; the controller was correctly fixed. Witness thought that the mishap was due to the operator having switched on before inserting the plug. It was elicited from the witness Smith that he had had no proper instruction in the handling of the apparatus. The jury found that Bacon was accidentally killed, adding that it considered that proper rules should be drawn up and strictly adhered to.

A Fan Adapted for the Removal of Suspended Particles.—A modification in the design of the ordinary paddle-wheel type of fan blower, whereby it is adapted for the removal of cinders and dust from the air it handles, has been developed by the B. F. Sturtevant Co. Buckets are provided at the inlet edges of the blades, and from each bucket an inclined channel leads the dust to a special dust chamber, where it drops out of suspension and is removed from hoppers periodically.

It is claimed that this type of blower is just as efficient a fan as the average induced-draft fan, and that it removes up to 75 per cent. of the solid matter in the air, depending, of course, on the nature of the material. Two large fans installed in connection with six 500-h.p. boilers in New York City each remove about 250 lb. of cinders per hour when the boilers are operating at 200 per cent. of rating. This type of fan has also found successful application in connection with boilers using pulverised fuel.—*Chem. and Met. Engineering.*

INSTITUTION NOTES.

The Institution of Electrical Engineers.—WIRELESS SECTION COMMITTEE, 1922-23.—The following members have been nominated to serve on the Wireless Section Committee for 1922-1923: Chairman, Prof. G. W. O. Howe, D.Sc. New nominations for membership of the Committee: S. Brydon, M.Sc.; J. St. Vincent Pletts; Capt. H. R. Sankey, C.B., C.B.E., R.E. R. L. Smith-Rose, B.Sc. The following will continue to serve as members of the Committee: B. Binyon, O.B.E.; R. C. Clinker; Dr. W. H. Eccles, F.R.S.; Prof. C. L. Fortescue; G. H. Nash, C.B.E.; C. C. Paterson, O.B.E.; Capt. H. J. Round, M.C.; L. B. Turner, M.A.

Not later than 14 days after the publication of the Committee's list of nominations, any five members of the Wireless Section may nominate any other duly qualified person to fill any vacancy.

LIVERPOOL SUB-CENTRE.—The third annual report of the Sub-Centre states that seven ordinary meetings have been held, with an average attendance of 99 members. The membership increased in total from 367 to 447. The Council of the Institution has agreed to the inclusion of the whole of the counties of Flint, Denbigh, Merioneth, Montgomery, and Carnarvon, and also the Island of Anglesey, within the North Western Area; this territory has been added to the Sub-Centre's area.

Institute of Transport.—On Wednesday last, Sir Henry P. Maybury, K.C.M.G. (President), opened the London Transport Congress at the Institution of Civil Engineers. The President of the Board of Trade (Mr. Stanley Baldwin) was present, and welcomed the delegates. During the morning papers were read by Sir Cyril Kirkpatrick on "Recent Improvements in Transport Facilities in the Port of London"; Capt. H. Riall Sankey, C.B., on "Wireless as an aid to Transport"; and Col. C. H. Bressey, O.B.E., on "The Design, Construction and Maintenance of Highways in Relation to the Development of Mechanically-propelled Vehicular Traffic." In the afternoon visits were made to Wembley, Marconi House, the George V Dock, the new Great West Arterial Road, and the Somers Town goods station of the Midland Railway. Among the papers delivered yesterday (Thursday) was one on "The Future Design of Road Vehicles for Passenger and Goods Services," by Sir John I. Thornycroft, K.B.E. Visits were made in the afternoon to Lots Road power station, Messrs. Vickers's aviation works, and other places of interest. The Congress continues to-day and to-morrow, the latter day being devoted to visits to railway stations, telephone exchanges, &c. A conversazione was held at the Mansion House on Wednesday evening, the delegates being received by the Lord Mayor and Lady Mayoress.

Yorkshire Association of Mining Electrical Engineers.—Mr. J. H. WILLIAMS (Barnsley) has been elected President of the Association for the ensuing session, with Messrs. Roslyn Holiday, and J. R. Haigh (Lofthouse) as vice-presidents. Mr. W. Winter (Castleford) has been re-appointed hon. secretary.

Diesel Engine Users' Association.—JUNE MEETING.—At a meeting of the Association on June 2nd, at the Institution of Electrical Engineers, a paper on "Marine Diesel Engines," by Mr. H. F. P. Purday, B.Sc., is to be read and discussed. Non-members interested in the subject, and desirous of attending the meeting, can make application for tickets of admission to the honorary secretary at 19, Cadogan Gardens, S.W.3.

British Society of Engineers.—Mr. Caleb Smith (Walsall) has been elected president of this Society (which was founded in 1919) for session 1922-23. The Society is organising an aerial expedition to the North Pole, and it is also aiming at the establishment of 28 branches in the United Kingdom, each equipped with a wireless telephone receiving station. Particulars may be obtained from the secretary, Hon. Capt. C. Frobisher, 21, Nesfield Way, Stubbin Estate, Shirogreen, Sheffield.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

We have pleasure in giving a portrait of Mr. C. LE MAISTRE, secretary of the B.E.S.A. and the I.E.C., which we have extracted from him with the utmost difficulty, his view being that while his association is, of course, highly meritorious, his own personality is merely a part of the organisation, of no particular interest to our readers. But we have our own views on the subject, and we think that anyone who is personally acquainted with Mr. le Maistre, and with the strenuous labours which he undertakes on behalf of the two bodies above mentioned, in the interests of British industry, will agree that his personality, his tact, his diplomacy, his courtesy, and above all, his tireless energy, have had a large share in raising the B.E.S.A. and the I.E.C. to the high plane of efficiency and appreciation which they now occupy.

Mr. LE MAISTRE has been connected with the work of standardisation since its very early days, having joined the staff of the Engineering Standards Committee, as it then was, at the beginning of 1903. It is interesting to note that the Association reached its 21st birthday on April 26th last. Mr. le Maistre assisted Colonel Crompton, the honorary secretary and founder of the International Electrotechnical Commission, in the gathering together of the electricians of the world to form the I.E.C., of which he has been the general secretary since

its inception, and in connection with which he has travelled in over twenty different countries. Just before the war broke out the I.E.C. held one of its most successful meetings in Berlin, when 25 nations were represented, the meeting being held in spite of many difficulties.

In 1916, on behalf of the Electrical Section of the Standards Committee, Mr. le Maistre went to America to confer with the Standards Committee of the American Institute of Electrical Engineers. He also visited Canada. It was during his absence on his visit that the late secretary of the Engineering Standards Committee, Mr. Leslie Robertson, was lost on the *Hampshire* with Lord Kitchener. When he came back from America, Mr. le Maistre was appointed as Mr. Robertson's successor. On hearing the sad news of Mr. Robertson's loss, which was telegraphed to him in Canada, one of the most vivid recollections he had was of spending the last evening before sailing, with his late chief, with whom, during latter years, he had become extremely friendly, and to whom he was very attached.

When Mr. le Maistre took over the work of the Engineering Standards Committee in 1916 there were 100 committees; now there are over 400. The work has increased at least five-fold,

Mr. C. D. Le Maistre, C.B.E.,
Secretary of the British Engineering Standards Association.

and in spite of many difficulties, not the least being the financial one, the Association is, as the Americans say, "delivering the goods."

Mr. le Maistre, who was born in Jersey in 1874, was educated at Brighton College and at the Central Technical College, where he obtained his diploma; his engineering training was gained in the old Thames Iron Works. He also passed some considerable time in consulting work, country house and factory lighting.

In 1919, as secretary of the B.E.S.A., he went to Canada and the United States, and was consulted by the founders of the American Engineering Standards Committee, then in the throes of organisation. Professor Comfort Adams was at that time chairman of the American committee, and, with him, Mr. le Maistre had many interviews with members of the American Government, the Bureau of Standards, and the various American Engineering Societies, all of whom were much impressed with the progress being made in Great Britain in co-ordinating industrial standardisation.

In 1921, with the consent of the main committee of the B.E.S.A., he acted as chairman of an unofficial conference of secretaries of the various standardising bodies now in existence. Although the meeting was unofficial, its recommendations have been placed before the executive committees of the respective standardising bodies, and this should be of considerable assistance in promoting, along right lines, international agreement on standardisation generally. He is a corporate member of the Institution of Civil Engineers (A.M.Inst.C.E.), a member of the Institution of Electrical Engineers, an Associate of the City & Guilds Institute, the Central Technical College, and he is the local honorary secretary of the American Institute of Electrical Engineers. For his connection with aircraft work during the war he received the C.B.E.

Sir T. H. Holland, K.C.S.I., K.C.I.E., D.Sc., F.R.S., has accepted the invitation of the governing body of the Imperial College of Science and Technology, London, to be rector, in succession to Sir Alfred Keogh, G.C.B., LL.D., who is retiring at the end of August under the age limit.

The Delegacy of the City and Guilds (Engineering) College, which forms the engineering section of the Imperial College of Science and Technology, has appointed Professor C. L. Fortescue, O.B.E., M.A. (Cantab.), M.I.E.E., of the Royal Naval College, Greenwich, to succeed Professor T. Mather, F.R.S., who is resigning the Chair of Electrical Engineering in the college at the close of the present session.

Sir Richard Gregory, F.R.A.S., F.Inst.P., has accepted the position of president of the Decimal Association, in succession to the late Lord Belhaven and Stenton.

At a meeting of the Faversham Town Council, last week, a letter was read from the Association of Municipal Electrical Engineers protesting against the reduction of the salary of the electrical engineer (Mr. Sommerville) to £396 per annum, and asking the Council if it could not at present see its way to pay him the Association's scale and continue the salary paid to him in 1921. The Council decided to adhere to the reduction.

Mr. Clifford Mitchell, works manager at Marconi's Wireless Telegraph Works, at Chelmsford, who has resigned, has been presented by the employés with an antique walnut bureau, a silver cigar case, and an address.

The Paisley Town Council is reducing salaries of a number of officials; the reduction in the case of the electrical engineer is £36.

According to *The Times*, Mr. Henry J. B. Chapple, B.Sc. (Engineering), Whitworth Scholar, has been appointed lecturer in electrical engineering at the Bradford Technical College.

Dr. Frank B. Jewett, of New York, has been elected President of the American Institute of Electrical Engineers for the ensuing year.

Mr. J. W. Rodger, A.M.I.E.E., who for some years has been chief transformer designer and assistant manager with Messrs. Ferranti, Ltd., has relinquished his connection with them in order to take up a similar position with the Hackbridge Electric Construction Co., Ltd.

Mr. J. J. Butler has been appointed Manchester District Secretary of the Federation of British Industries, as successor to Mr. John Haworth, who has retired. Mr. Butler has been the F.B.I. special organiser for the East Midland area for nearly three years.

Obituary.—Mr. W. J. Chadburn.—Mr. W. J. Chadburn, who has died at Mansfield, at the age of 68, was a director of the Mansfield Tramways Co. He was Mayor of Mansfield in 1899.

Mr. T. F. Judge.—*The Times* records the death of Mr. Thomas F. Judge, mill superintendent of the Anglo-Newfoundland Development Co's Paper mills, which occurred at Grand Falls, Newfoundland, last Friday. "Mr. Judge went to Grand Falls in 1908 to arrange for and superintend the installation of electrical power and lighting plant. He was appointed head electrical engineer, and ten years ago he became mill superintendent at Grand Falls. Before joining the Anglo-Newfoundland Development Co. he had supervised similar electrical installations at St. Croix Mills and Laurentide Mills, under the direction of Mr. G. F. Hardy, of New York. The excellence of the power and lighting plant at Grand Falls bears witness to the skill and thoroughness of his work."

Mr. W. B. Whyte.—Mr. William Bebtie Whyte, electrical engineer at the Beachley power station, was killed in a motor accident, which took place on Thursday night last week at Pennsylvania Village, near Chepstow.

NEW COMPANIES REGISTERED.

Park Electrical and Engineering Co., Ltd. (181,622).—Private company. Registered May 8th. Capital, £10,000 in £1 shares. To acquire the land and buildings in Ashburton Road, Trafford Park, Manchester, now owned by the Park Electrical and Engineering Co., and to carry on the business of electrical and mechanical engineers, electricians, and manufacturers, &c. The permanent directors are:—G. L. Brown, "Fernlea," Park Hill Drive, Ruthergien, Lanark, engineer; A. C. Penny, "Spring Bank," 32, Talbot Road, Old Trafford, Manchester, engineer. Qualification, £500. Remuneration as fixed by the company. Secretary: G. L. Brown. Solicitor: J. Prior, 438, Corn Exchange Buildings, Manchester.

Magneto Repair and Winding Co., Ltd. (181,658).—Private company. Registered May 9th. Capital, £500 in £1 shares. To take over the business of magneto repairing and electrical engineering carried on by D. Jones at 5, Salubrious Place, Swansea, as the "Magneto Winding and Repairing Co." The provisional directors are:—D. Jones, "Vaudeville," Tyeroes, Pantyffynnon, Carmarthenshire Line, colliery examiner; F. H. Thomas, 132, Bryn Road, Swansea, electrical engineer. Qualification, £100. Secretary: D. Jones. Registered office: 5, Salubrious Place, Swansea.

Russell Electrical Appliances Co., Ltd. (181,431).—Private company. Registered April 29th. Capital, £2,000 in £1 shares. To acquire and work electric meter patent No. 4,368/22, of which L. T. C. Russell is the sole patentee, &c. The permanent directors are: L. T. C. Russell, 21, Manor Road, Stamford Hill, N.16; W. G. Dewsbury, 5, Bergholt Crescent, N.16; E. W. Jones, 2, Treviso Road, Forest Hill, S.E. Qualification: 100 shares. Remuneration, as fixed by the company. Secretary: [illegible]en R. Reed. Registered office, 60, Queen Victoria Street, E.C.4.

Gas and Electricity Development Co., Ltd.—Registered on May 9th as a private company, with a nominal capital of £2,000 in £1 shares. The objects are: To adopt an agreement with Sir Charles Bright & Partners, Ltd., The Premier Gas Engine Co., Ltd., Crompton & Co., Ltd., and F. J. Palmar, and to carry on the business of gas, electricity, and water supply, metallurgical, mechanical, and chemical engineers, electricity and gas makers and distributors, consultants, technical and financial advisers, and heat, light, and power specialists, &c. The signatories to the Memorandum of Association (each subscribing for one share) are:—E. W. Goodale, 6a, Bedford Square, W.C.1, solicitor; R. W. Fiddes, 170, Hainault Road, Leytonstone, E.11, clerk. Sir Charles Bright & Partners, Ltd., have the right to appoint two directors, and the remaining parties to the above agreement have the right to appoint one director each. The first directors are not named. Qualification (except nominees as above), 100 shares. Remuneration as fixed by the company. The registered office is 146, Bishopsgate, E.C.2. The file number is 181,648.

Sir Charles Bright & Partners, Ltd.—Registered on May 10th as a private company, with a nominal capital of £2,000 in £1 shares. The objects are: To adopt an agreement with Sir Charles Bright & Partners and to carry on the business of advising, inspecting, consulting, and superintending engineers, electric (including telegraph, telephone, and submarine cable), gas, mining, and railway engineers, naval and general architects, technical experts in shipping and engineering matters, &c. The permanent directors are:—Sir Charles Bright, "Leigh Grange," Kent, civil engineer (chairman); A. H. Seabrook, Potters Bar, Middlesex, engineer; A. J. Stubbs, "Carlisle Lodge," Woodside, Surrey, civil engineer; Lt.-Col. H. W. Wordall, "Stinsford House," Dorchester, engineer. Qualification of permanent directors, 100 shares; of ordinary directors, 250 shares. Secretary: A. J. Stubbs. The registered office is 146, Bishopsgate, E.C. The file number is 181,695.

Illuminated Identification Number Plate Co., Ltd. (181,688).—Private company. Registered May 10th. Capital, £500 in £1 shares. To carry on the business of manufacturers and sellers of parts and apparatus of all kinds for lighting, illuminating, and heating, contractors, general engineers, ironfounders, mechanical engineers, tool makers, brassfounders, welding engineers, manufacturers of goods in connection with lighting or motor vehicles and cycle trades, dealers and letters to hire of motors, cars, cycles, carriages, and vehicles, manufacturers of and dealers in lamps, lanterns, burners, mantles, &c. The subscribers (each with one ordinary share) are:—D. A. Ellam, 10, Raglan Street, Halifax, millwright; H. Robinson, 72, High Street, Halifax, engineer; N. R. Spencer, 75, Old Lee Bank, Halifax, solicitor's clerk. The first directors are not named. D. A. Ellam signs as manager. Registered office: 10, Raglan Street, Halifax.

Newcastleton Electric Supply Co., Ltd. (12,204).—Private company. Registered in Edinburgh May 9th. Capital, £1,000 in £1 shares. To carry on business as indicated by the title. The first directors are:—Miss Agnes Scott, 6, Langholm Street, Newcastleton; C. Wood, 6, Langholm Street, Newcastleton, engineer; T. Martin, 9, Langholm Street, Newcastleton, retired; T. J. Ewart, 5, Union Street, Newcastleton, draper; T. Oliver, 3, Doncaster Street, Newcastleton, grocer; A. Oliver, 18, South Hermitage Street, Newcastleton, grocer; R. Wilson, Grapes Hotel, Newcastleton, chauffeur; J. Davidson, 13, Winchester Lane, Newcastleton, retired; D. Oliver, 37, South Hermitage Street, Newcastleton, grocer; I. Carruthers, 1, Doncaster Street, Newcastleton, baker. Qualification, £50. Registered office: 44a, South Hermitage Street, Newcastleton.

Superadio, Ltd. (181,747).—Private company. Registered May 12th. Capital, £1,000 in £1 shares. To carry on the business of manufacturers, exporters and imporers of and dealers in wireless telegraphic and telephonic appliances, installations, goods and accessories of all kinds, electrical, gas, oil and lighting goods, &c. The subscribers (each with one share) are:—C. Orgel, 24, Queen Elizabeth's Walk, N.16, electrical accessories dealer; S. Orgel, 107, Queen's Road, Finsbury Park, N.4, wireless and electrical accessories merchant. The subscribers are to appoint the first directors. Registered office: 111, Great Eastern Street, E.C.

Acme Production Co., Ltd. (181,752).—Private company. Registered May 12th. Capital, £3,000 in £1 shares. To acquire the business of manufacturers of and dealers in electrical and mechanical appliances and scientific instruments now carried on by W. J. Allen and W. D. Vick at 73½, Coleshill Street, Birmingham. The permanent directors are:—W. J. Allen, Peak House, Westbourne Road, Walsall, electrical specialities manufacturer; W. D. Vick, 23, Florrence Road, Acocks Green, electrical specialities manufacturer; W. H. Fulford, no address given. Remuneration of W. J. Allen and W. D. Vick £260 each per annum, and in addition a yearly percentage of the said sum of £260 calculated at the same rate per cent. as the rate of dividends declared for the year on the ordinary shares. No remuneration for W. H. Fulford. Registered office: 73½, Coleshill Street, Birmingham.

Wholesale Electrical Co. (1922), Ltd. (181,751).—Registered May 12th. Capital, £20,000 in 20,000 cumulative 10 per cent. participating preference shares of £1 each and 10,000 ordinary shares of 1s. each. To adopt an agreement with A. W. Little, and to carry on the business of ironfounders, mechanical and electrical engineers, manufacturers of machinery and electrical equipment, toolmakers, brassfounders, metal workers, &c. The first directors are:—A. W. Little (chairman), Avonhurst, Freshford, Bath (director of Wey Engineering Co., Ltd.); H. E. Rutherdon, 1, Oxford Villas, Limpley Stoke, Wilts. (director of the Wey Engineering Co., Ltd.); T. W. Greaves, Dorney House, Weybridge, Surrey. Minimum cash subscription: 7 shares. Qualification: 1 share. Remuneration, £75 each per annum (chairman £100). Registered office: 5, Guildhall Chambers, 31-4, Basinghall Street, E.C.2.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Northampton Electric Light and Power Co., Ltd.—Issue on April 27th, 1922, of £40,000 7 per cent. second debenture stock, part of a series already registered.

Weydon Lamp Co., Ltd.—Particulars of £3,000 in debentures, authorised March 1st, 1922. Present issue, £1,300, charged on the company's undertaking and property, present and future, including uncalled capital.

Bodmin Electric Light and Supply Co., Ltd.—Issue on May 2nd, 1922, of £100 debentures, part of a series already registered.

Joseph Walton & Son (Nelson), Ltd.—Debenture, and as collateral security thereto, a mortgage charged on the company's undertaking and property, present and future, including uncalled capital, and certain lands and premises in Nelson, both dated April 24th, 1922, to secure all moneys due or to become due from the company to the Bank of Liverpool and Martins.

Remco Carbon Co., Ltd.—R. Crane, of 46 and 47, London Wall, E.C., was appointed receiver on March 1st, 1922, under powers contained in debentures dated November 29th, 1918.

Bombay Electric Supply and Tramways Co., Ltd. (in liquidation).—Satisfaction in full on March 30th, 1922 (a) of debenture stock dated November 7th, 1905, securing £600,000, and (b) of charge contained in trust deed dated May 13th, 1909, securing £210,000 second mortgage debentures.

St. James' & Pall Mall Electric Light Co., Ltd. (26,015).—Capital, £300,000 in 40,000 ordinary and 20,000 preference shares of £5 each. Return dated March 14th, 1922. All shares taken up. £298,250 paid on 39,650 ordinary and 20,000 preference. £1,750 considered as paid on 350 ordinary. Mortgages and charges, £150,000 3½ per cent. debenture stock.

City of London Electric Lighting Co., Ltd. (34,406).—Capital, £2,000,000 in 400,000 6 per cent. first preference, 300,000 8 per cent. second preference, and 800,000 ordinary shares of £1 each, plus £500,000 undenominated. Return dated March 29th, 1922. All the first and second preference and ordinary shares taken up. £1,500,000 paid. Mortgages and charges, £800,000.

James Keith & Blackman Co., Ltd.—Issue on May 1st, 1922, of £300 debentures, part of a series already registered.

Barraclough Brothers, Ltd.—H. S. Dickinson, of 30, Huddersfield Road, Brighouse, ceased to act as receiver on August 24th, 1921 (notice filed May 11th, 1922).

CITY NOTES.

English Electric Co., Ltd.

The ordinary general meeting was held on May 16th at the Connaught Rooms, Sir C. E. Ellis, G.B.E., K.C.B., in the chair. Proposing the adoption of the report, the chairman said the balance sheet showed for the first time the full liability for the note issue. It showed also, however, a considerable reduction under the heading of sundry creditors and credit balances. On the assets side this year's figure for land, buildings, plant, machinery, &c., covered an increase of nearly £700,000, whereas the interest in subsidiary and other companies was less by approximately £825,000 than a year ago. These differences indicated further progress in the absorption of the constituent firms into a unified system. During the year the Dick, Kerr works at Preston had been transferred and the Coventry Ordnance Works leased to the company. The stocks had in the aggregate been very much reduced during the year, both in quantity and value. As early as 1920 they were able to foresee, to some extent at least, that, although orders still continued to flow in, the market was, in fact, being exhausted. Consequently they began to reduce their stocks to the lowest possible limits. In addition to making the reduction in quantity, they had met the heavy fall in the market value of all materials during the year by a special writing-down of the stocks, item by item, to a figure which represented to-day's replacement value or less. From the profit and loss account it would be seen that the available balance was slightly in excess of that of last year, and that the net profits brought to credit for the year included dividends received from subsidiary companies, and amounts transferred from reserves previously set aside and no longer required. He though they would agree that the result was satisfactory. The record of 1921 was not the only factor which they had had to consider in determining what distribution they should make to the ordinary shareholders. They had felt bound also to look ahead, and there they saw uncertainties on every hand, and the board, in recommending a dividend on the ordinary shares at the rate of 5 per cent. per annum, considered that it had not unfairly reconciled the natural expectations of the shareholders with the needs of a difficult and obscure period to come. During the year steps had been taken to effect every possible economy throughout the company's organisation. There were obvious difficulties in carrying out a task of this nature if the inevitable hardship to individuals was to be mitigated without sacrificing the interests of the business as a whole. They would be glad to know that, great as the economies had been, their selling organisation at home and abroad, both in the number and calibre of their representatives, had been increased and strengthened. On the general trade position during last year and the present outlook throughout the world he need add little to the remarks he had already made. The appalling chaos in many of their best markets, and the apparent failure of any scheme on a grand scale to breathe new life into the trade of Europe, had produced a situation without precedent in British industry in modern times. While they welcomed Government assistance, both direct and indirect, particularly as regarded finance, he was strongly of opinion that the best and soundest way out of most of present difficulties would be found to be through the efforts of private enterprise. Trade was less in need of new channels than of the removal of encumbrances from the old ones. So strongly did they hold this view that they had recently, with five powerful associates of world-wide reputation, formed the Power & Traction Finance Co., Ltd., with the object of dealing with comprehensive engineering contracts on a large scale. In spite of general economic conditions it remained true that the electrical industry had been less seriously affected than many others. It had the advantage amongst the industries of this country of youth and vigour. In its modified prosperity their company had retained a full share. During the last year they had secured many important contracts. Amongst them were a complete central station installation, comprising buildings and plant, for the Borough of Leicester, important railway electrification contracts in Spain and in Japan, and others. On all sides there were signs that public works too long delayed were shortly to be put in hand, and in this respect the future

was full of promise. Competition by Germany and other countries with depreciated currencies had not been so serious as the abnormal rates of exchange would appear to imply. In many cases this had been due to a well-founded doubt in the mind of the buyer whether those countries were sufficiently stable, either industrially or politically, to enable them to maintain the deliveries offered. Low prices were a poor substitute for confidence which had been destroyed. German export trade had also been severely restricted by feverish activity at home. Recent reports, however, suggested that this internal boom was waning. If, in consequence, Germany and their other European competitors were able to offer very much shorter deliveries for their exports, the menace of their competition might yet be felt in a more severe form. Railway electrification, less on technical than on financial grounds, had made relatively slight progress in this country. But it was at least satisfactory to note that the two railway electrification contracts placed for the Dominions since the armistice —one for the Government of New Zealand and one for the Government of South Africa—had been placed in Great Britain; the former contract was secured by their company. On the technical side of their business the last year had been one of ceaseless activity. Improvements in their existing designs and in many cases entirely new lines of machinery had been developed, manufactured, and put into operation, and already the satisfactory performance of this more modern plant was bearing fruit, both at home and abroad. The progress of re-allocating the classes of work amongst their several factories in order to secure increased efficiency had proceeded a step further. The effect of the specialisation of certain factories to a particular kind of operation was already making itself felt in reduced costs and better production. Taking, for instance, the case of electric traction equipments, he thought he was correct in saying that the sections of the Lancashire & Yorkshire Railway, electrified by Messrs. Dick, Kerr, and those of the North-Eastern Railway, electrified by Messrs. Siemens, were the only two main-line railways in Great Britain operating with direct-current at a pressure even approximating to that now proposed for modern schemes Instead, however, of continuing to manufacture these equipments in two works, the whole of the output, with the technical experience and staff of both concerns, was concentrated at Preston. This principle was being carried out over the whole range of their products, and was one of the outstanding advantages to be gained by a combination such as their own. Perhaps the most disturbing feature in the prospects for the electrical industry was the continuance of the engineering lock-out. If the favourable view with which foreign buyers had regarded the industrial stability of this country in the past was to be threatened by disputes such as this the trade revival in this country might be indefinitely postponed. That was neither the time nor place to discuss the merits and demerits of the engineering lock-out, but it was, in his judgment, certain that the vast number of workmen and employers were prepared to take the commonsense view that by real co-operation, and not by abuse of power on either side, were the security of one class and the aspirations of the other to be achieved. Whilst expressing a determination loyally to support the majority of the great federation to which their trade was allied, they were bound to say that in all their works the relations between their workpeople and themselves were excellent in every way. The damage to British trade in the eyes of the world by the present serious labour dispute in this country would be almost irreparable unless it was brought to a rapid conclusion, and he sincerely trusted that the joint meeting which was to be held would be the precursor of a settlement satisfactory to both parties. It might be that there were extremists on one side or the other, but whether that was so or not a most grave responsibility rested upon the negotiators, which could only be met by a policy of co-operation and goodwill.

Lord Meston seconded the motion, and the report was unanimously adopted.

Cork Electric Tramways and Lighting Co., Ltd.

During 1921 the revenue was £114,773 and the expenses were £98,772, leaving £16,001 plus £5,703 brought forward. Income tax absorbs £2,053, interest account £251, interest on debentures £4,600, and there is transferred to reserve for depreciation and renewals £12,000, leaving a balance of £2,800 to be carried forward. The revenue from the tramways was £1,406 less than for the previous year due to the strike. The revenue from lighting and power shows an increase of £6,430 and the profits on supply sales, discounts, &c., a decrease of £1,018. The cost of generating was £1,593 less than for the previous year due to the fall towards the end of the year in the price of coal. There were increases of (*a*) £687 in the cost of maintaining and operating the tramways, (*b*) £1,841 in the lighting and power distribution expenses, (*c*) £2,576 in insurances, management, and other general expenses, and (*d*) £293 in bad debts. In view of the heavy losses sustained by the company last year through (1) the two months' strike of its employés, (2) the subsequent coal strike which involved the purchase of large stocks of coal at exorbitant prices in order to maintain the supply of energy, and (3) the disturbed state of the country during the first half of the year, which severely affected business generally, the directors consider the results satisfactory. The capital expenditure during the year amounted to £35,031, mainly for the installation of a 2,000-kW Curtis turbine and other plant at the Cork generating station, additional cables and house services to meet the increasing demand for lighting and power, and new plant installed at the Queenstown station to reduce the cost of generating. The revenue to date shows an increase over the corresponding period of last year and enables the company to pay a half-year's dividend on the 5 per cent. cumulative preference share capital. This payment will clear the arrears to June 30th, 1920.

Potteries Electric Traction Co., Ltd.

The capital expended during 1921 was £12,199. The revenue for the year was £300,832.

The traffic and parcels receipts amounted to £283,153, exceeding those of 1920 by £2,521. The expenses increased by £6,562. After deducting all expenses chargeable to revenue, including £11,025 for debenture interest, and a provision of £10,000 for renewals, there remains £27,841, as compared with £28,500 for 1920. Adding £6,082 brought forward, there is available £33,923.

Out of this there is placed to reserve account £5,000; a dividend on the preference shares (5 per cent. per annum) requires £12,250; a dividend on the ordinary shares at the rate of 4 per cent. per annum requires £9,800; and £6,873 is to be carried forward.

The reserve will now stand at £114,523, and the renewals fund at £55,891.

The traffic receipts for the first few months of the year showed substantial increases on both the tramway and omnibus services. Later, the coal miners' strike, competition by independently-owned vehicles, and general trade depression in the district caused a serious falling-off in the number of passengers carried. The motor omnibus services were extended. Working expenses continued high during the year.

Babcock and Wilcox, Ltd.

The net profit for the year 1921 was £490,181, plus £99,828 brought forward, making £590,008. Out of this were paid the interim dividends (November 3rd, 1921) of 3 per cent. on the preference shares, 2½ per cent. on the second preference shares, and of 7 per cent. on the ordinary shares, amounting to £157,894, and the directors recommend that the following dividends be paid for the half-year ended December, 1921, viz.: 3 per cent. on the preference shares, less income tax, £3,000; 2½ per cent. on the second preference shares, less income tax, £4,476; 9 per cent. on the ordinary shares (free of income tax), £193,394; there is to be put to reserve fund £150,000, to staff pension fund £10,000, and £71,243 remains to be carried forward. "During the year under review a good many contracts were carried out which were placed with us during the preceding year, and, in common with other engineering concerns, we have been affected by the slump in trade. The recent labour disturbance has, of course, temporarily reduced our output. It will be seen that the amount we have to provide for income tax and Corporation profits tax is most oppressive, and, notwithstanding the small reduction just made, in our opinion such burdensome taxation cannot fail to continue to adversely affect all British industries."

Calcutta Electric Supply Corporation, Ltd.

Lord Meston, K.C.S.I., presided at the annual meeting held at the company's London offices on May 9th. In moving the adoption of the report and accounts the chairman said that during the year the total amount of capital expenditure had risen from 1¾ millions to 2¼ millions sterling. This was due to the purchase of new plant, which, it was hoped, would soon be adding to the company's revenue. Although a small surcharge had been imposed upon the price of energy sold this was more than absorbed by increased charges for coal and labour. There was no profit on exchange during the year.

Although there had been labour troubles in the course of the period under review, these had been successfully handled by Mr. Martens, the company's agent, and the shareholders could be congratulated upon having a loyal and competent staff. When the company applied for an extension of ten years (to 1938) of the first period at which the Bengal Government had the option of purchasing the undertaking, some criticism was made by the City Council; nevertheless the extension was obtained. Trade in England was still hampered by the engineering dispute. Such a state of affairs would surely drive the most patriotic firms to place orders for heavy electrical plant outside England. In India there was a reaction against recent political extravagances, although the period of trial was not yet at an end. India needed enterprises like that of the company which catered for her industrial welfare. The company had been in existence for 25 years, during which period it had attained a position of great importance; even so it was still merely at the threshold of great possibilities. Lord Meston, in conclusion, mentioned with regret the death of Mr. G. S. Williams, deputy agent, and the retirement, through ill-health, of Mr. F. R. Reeves; the latter's place on the board had been filled by Sir George Sutherland.

In seconding the chairman's motion, Major-General R. H. Mahon, C.B., C.S.I., deputy chairman, gave some details of his recent visit of inspection. He spoke of the remarkable growth of the city of Calcutta since his last visit nine years previously, a development in which the company had participated. Their supply area now covered not only the district

administered by the Calcutta Council, but also the areas of nine or ten other municipalities. In the company's dealings with the Calcutta Municipal Council it had to be realised that the Council had to endeavour to obtain amenities for its ratepayers at as low a cost as possible, which made its position difficult. He was glad to say, however, that good relations had been established after consultation with the municipal leaders. Gen. Mahon was of the opinion that the majority of the Indians valued their partnership in the British Empire, and were not anxious for a change of government. In concluding, he desired to express his appreciation of the work of the staff, from the boiler-house employés to the agent. After the re-election of the retiring director, Mr. A. M. H. Walrond, and the re-appointment of the auditors, the chairman moved the following resolution:—

"That the directors be, and they are, hereby authorised to borrow or raise, such sums as they think fit, provided that the total amount at any one time outstanding in respect of moneys borrowed or raised by the directors shall not, without the sanction of a general meeting of the company, exceed £500,000 in addition to (1) the amount which the directors are empowered to borrow or raise under Article 83 (H) of the Articles of Association, namely, one-half of the issued share capital of the company, and (2) the £100,000 sanctioned at the extraordinary general meeting of the company held on May 12th, 1921, and (3) the amount of any advances that may from time to time be outstanding in respect of loans obtained by the company in England against or on the security of cash, notes, or bills held by the company or standing to the company's credit with any bank or financial institution in India."

The motion was seconded by the deputy chairman, and unanimously adopted.

Bath Electric Tramways, Ltd.

Speaking at the annual meeting on May 10th, Mr. J. B. Hamilton, C.B. (chairman), said that, in spite of assertions to the contrary, there was not much fear that tramways would be superseded by other forms of traction. Due to the fine summer and the increased fares sanctioned by the Ministry of Transport, the revenue had shown a considerable increase. Repairs and maintenance charges had, however, reduced the net revenue. The first mortgage debentures had been reduced and the sinking fund increased during the year. The Bath Tramways Motor Co. had done well, and was proving a good investment. Referring to road maintenance charges, the chairman said that a movement was being made by tramway undertakings to get rid of a part of this burden, and he had hopes of its success.

Indian Electric Supply and Traction Co., Ltd.

The directors report that for the year ended December, 1921, the surplus on working in Cawnpore was £26,502 (against £34,970 in 1920), and including transfer fees and bank interest the credit side of net revenue account shows a total of £30,500. The actual net earnings in India were Rs.4,35,232, as against Rs.4,10,222 for 1920, but the sterling equivalent was lower, owing to the fall in exchange from the exceptional rates realised last year. London expenditure was £2,433 (against £2,462 in 1920), and after providing £2,980 for debenture interest there is a profit of £25,087. The amount brought forward was £5,075. The interim dividend of 3 per cent. on the ordinary shares absorbed £2,952, and a final dividend of 7 per cent., making 10 per cent. for the year, requires £7,159. Dividends for the year on the preference shares absorbed £8,201. There is put to reserve for depreciation and renewals £7,736, and directors' commissions on dividends amount to £916, leaving to be carried forward, subject to taxation, £3,198. Meeting: London, May 22nd.

Callender's Cable and Construction Co., Ltd.

The accounts for the year ended December 31st, 1921, show a balance to the credit of profit and loss account of £217,012. From this must be deducted interest on debenture stock £13,500; dividend on 6½ per cent. preference shares for year, £26,000; dividend on 7½ per cent. preference shares for year, £30,000; appropriation for depreciation of buildings, plant and machinery, £30,000; appropriation for depreciation of office furniture, £500; leaving a balance of £117,012; to which is added the balance from 1920 of £108,101, leaving an available balance of £225,113. It is proposed to pay a dividend on the ordinary shares at the rate of 15 per cent. per annum, less income tax, being 3s. per share, of which 1s. per share, less income tax, was paid in November, 1921, and 2s. per share less income tax will be paid forthwith, £75,000; leaving to be carried forward £150,113.

The company's operations were seriously hampered by the stoppage of production in the coal trade during the early part of 1921. No adequate supplies of fuel could be obtained, and it became necessary to close the workshops, so that for over two months output practically ceased. In spite of this the accounts for the past year show results which are, in the opinion of the directors, satisfactory. Re-organisation in the workshops and other economies have resulted in greater efficiency and diminished cost of production, which have contributed to those favourable results. The machinery for the manufacture of e.h.p. cables for 30,000 volts and upwards, with the extensions made during the year, is now in full operation. In the latter part of the year there was a falling off in the demand, both at home and abroad, for wires and cables of all descriptions. This was, however, counteracted by important contracts previously secured by the company. Foreign business has been difficult, especially with the Continent, on account of adverse exchanges and other conditions, which have affected all British industries. Every possible step is being taken to safeguard and extend the company's interests abroad. The Anchor Cable Co. at Leigh has been similarly affected, especially with its foreign business. There are, however, some signs pointing to the resumption of better trade in this country.

Meeting: London, May 25th.

Anglo-American Telegraph Co., Ltd.

The four dividends paid in April, July, November, and February, together with £78,750 for income tax, absorbed altogether £262,500, being the rent paid by the Western Union Telegraph Co. for the year, equal to 3¾ per cent. on the ordinary stock, 6 per cent. on the preferred stock, and 1¼ per cent. on the deferred stock. Bonuses of 2s. 3d. per cent. upon the ordinary stock and 4s. 6d. per cent. on the deferred stock were paid in February. The balance at credit of revenue account available for the payment of dividends for the quarter to March 31st, 1922, is £65,625.

Northern General Transport Co., Ltd.

The traffic receipts (less working expenses), dividends, and other revenues for the year 1921, amounted to £59,411. After providing for administration expenses, deducting £6,111 for loan and debenture interest, and making a provision of £18,367 for renewals, there remains £29,938, plus £18,540 brought forward. There is put to sinking fund for redemption of debenture stock £1,411; dividend, 6 per cent. for the year, on the preference shares £6,523; dividend, 10 per cent. for the year, on the ordinary shares £22,711; carried forward £17,833. During the year the additional capital expenditure on the motor omnibus undertaking amounted to £47,440. The fleet now consists of 117 motor vehicles, an increase of 20. The company's investments in the Gateshead & District Tramways Co., the Jarrow and District Electric Traction Co., Ltd., and the Tynemouth and District Electric Traction Co., Ltd., stand in the books at £402,909.

Prospectuses.—*The Indian Electric Supply & Traction Co., Ltd.*—The list was opened toward the end of last week for subscriptions to an issue of £250,000 five per cent. debentures, in denominations of £100 and £20 each (free of income tax). The issue price was 94 per cent. The money is required for the purpose of extensions of electricity supply producing facilities in the City of Cawnpore, where there is great industrial activity, which must lead to increased electrical demand. Holders of the existing 6 per cent. first mortgage debentures (£49,600 outstanding) have the option of converting into this issue. A sufficient sum of money is to be placed with the trustees of the first debenture holders to repay at maturity any of the existing debentures outstanding and to provide interest thereon, thus freeing the company's assets from all existing charges, and thereby making the present issue a first mortgage. The issued share capital is £240,000. On the ordinary shares 9 per cent. was paid for 1919, 10 per cent. for 1920, and 10 per cent. is recommended for 1921.

Calcutta Tramways Co., Ltd.—The list closed last week in an issue of £250,000 seven per cent. second (registered) debentures at 95 per cent., in denominations of £100. The object of the issue was to repay bank advances, to provide funds for additional plant and rolling stock to meet the requirements of the increasing traffic, and for the general capital purposes of the company. The ordinary shares received 10 per cent., tax free, for 1919, and 7 per cent., tax free, for 1920, but the accounts for 1921 are not yet complete, though it is stated in the prospectus that the earnings have been very adversely affected by unrest, strikes, &c. The chairman visited Calcutta in January and made arrangements with the men with a view to avoiding trouble in the future; increased fares were introduced on February 1st; and the traffic receipts for the first quarter of 1922 have increased by about £10,000 as compared with the corresponding quarter of 1920.

On May 3rd there were offered in New York $25,000,000 Pacific Telephone & Telegraph Co. refunding mortgage 5 per cent. bonds, series "A." The company is a subsidiary of the American Telephone & Telegraph Co. The issue was over-subscribed.

Johnson & Phillips, Ltd.—The report for 1921, which has just come to hand, states that the profits would have compared quite favourably with those of 1920, but for the heavy fall in prices of stocks and work in hand, which necessitated the writing down of values to current market prices. In view of the present state of trade caused by the engineers' lock-out, and the consequent falling off of business, the directors did not recommend the payment of a dividend on this occasion.

Submarine Cables Trust.—The revenue for the year ended April 15th, 1922, was £29,958 and expenses £1,983, leaving a balance of £27,974, plus £19 brought forward. After providing £7,941 to meet payment of coupons and £546 to be refunded to Inland Revenue, £19,456 has been transferred to redemption fund and £50 carried forward.—*Financial Times.*

German Telegraph Companies.—A *Reuter* dispatch from Berlin states that the united boards of directors of the German Atlantic, German South American, and East European Telegraph Companies have decided to recommend to shareholders the fusion of these companies. The German Atlantic Co. will increase its capital in this connection by 13½ million marks of ordinary shares as well as 2½ million marks of preference shares.

The Times Berlin correspondent, in referring to the matter, says: "The companies, which were compelled under the Treaty of Versailles to hand over their cables to the Allies against compensation from the German Government, have not yet come to an agreement with the Government. It is expected, however, that the negotiations, will be completed at the end of the present month, when a general meeting will be held to confirm the amalgamation."

Compañia Italo-Argentina de Electricidad.—The report for 1921 showed a gross profit of $m/n 1,801,092. A dividend of $9 per share was recommended, absorbing $983,336, and after paying directors' fees, contributing to reserve, &c., a surplus of $38,870 was carried forward. During the year a new 12,500-kVA turbo-alternator was put into commission at the "Pedro Mendoza," the principal station. The boiler plant was also added to. This station now contains five sets with an aggregate output of 43,750 kVA. Three new converter sets, of 1,000 kW each, were installed in three sub-stations. Over 25,000 metres of new cables was laid during the year. 77,477,300 kWh was generated at the main station, and 2,124,977 kWh at the Diesel sub-generating stations. The service was regularly and satisfactorily maintained.

Barcelona Traction, Light and Power Co., Ltd.—The directors have offered to holders of 5½ per cent. income bonds to exchange such bonds for 6 per cent. first mortgage bonds on the basis of giving £1 nominal value of 6 per cent. first mortgage bonds for every £5 nominal value of the 5½ per cent income bonds surrendered (with all coupons) for exchange. The 6 per cent. first mortgage bonds will have attached the half-yearly interest coupon due December 1st, 1922.

Vera Cruz Electric Light, Power and Traction Co.—The net profits in Mexico for 1921, amounted to 629,649 dols., which, converted into sterling at 24.5d. per peso, is equivalent to £70,708. As the actual exchange value of the Mexican peso exceeded 24.5d. during the year, exchange account again shows a profit. After meeting all expenses, debenture interest and annual sinking fund charge, there is an available balance of £64,752 plus £21,980 brought forward. It is proposed to pay a dividend of 10 per cent. for the year, of which 5 per cent. has already been paid, and a bonus of 2½ per cent., placing to depreciation and reserve account £20,000, and carrying forward £22,982.—*Financier.*

Pinchin, Johnson & Co., Ltd.—Mr. Edward Robson presided at the annual general meeting on May 10th. He said that in spite of abnormal conditions good results had been obtained, and he hoped that business would show an early improvement. A mortgage of £6,000 on one of the factories was repaid during the year, and at the present time there was not a single charge on the business in priority to their preference shares.

A Prague Electricity Loan.—The *Manchester Guardian* states that Messrs. Helbert, Wagg & Co., the London bankers, have tendered successfully for a loan of 1,500,000 sterling and $7,500,000 to the Municipality of Prague for the extension of the electricity, water, and gas works, which will be given as security for the loan.

American Telephone and Telegraph Co.—According to the *Financial Times*, this company has disposed of its holdings of common stock in the Radio Corporation of America. It is stated that it is the policy of the company only to hold the securities of its associated companies in the Bell telephone system.

Rhondda Tramways Co., Ltd.—According to the *Financier* the directors recommend a dividend of 4 per cent. on the preference shares, putting £495 to depreciation of furniture, &c., £5,000 to reserve and renewals account, £4,191 for loss on operating motor omnibuses, £30,828 for repairs and maintenance, and carrying £1,826 forward.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 148a:—Siemens Bros. & Co.—£466,000 4½ per cent. debenture stock.

Mexican Light and Power Co.—According to a financial daily it is announced that Coupon No. 6 (dated December 1st, 1914) will be paid on June 1st.

Gravesend and Northfleet Electric Tramways Co., Ltd.—After putting £1,000 to reserve and paying 6 per cent. on the preference shares for the year, £4,258 is to be carried forward.

Tynemouth and District Electric Traction Co., Ltd.—It is proposed to pay a dividend of 10 per cent. for the year on the ordinary shares, leaving £6,488 to be carried forward.

Castner-Kellner Alkali Co., Ltd.—A dividend at the rate of 8 per cent. actual (less tax) for the half-year ended at March is announced.

Coventry Chain Co., Ltd.—Interim dividend of 6 per cent. per annum on the ordinary shares for the half-year ended February, 1922.

Scarborough Electric Supply Co., Ltd.—According to the *Financier*, there was a net profit of £45 for the year, making with £9,817 brought forward, £9,862. The maximum dividend of 2½ per cent. is recommended, leaving £7,612 to be carried forward.

STOCKS AND SHARES.

Tuesday Evening.

The main feature of the markets is the way in which prices have rushed along in the Home Railway lists. Evidently the public imagination is stirred by the popular speculation of the moment, for there can be no doubt as to much of the buying partaking of the gambling order. When markets become more normal, as they will do from next Monday onwards, there is likely to be a general settling down of prices in this department. Undergrounds have scarcely gone at the same breakneck speed as some of the steam stocks, though Metropolitans and Districts are very substantially higher than they were at the beginning of the year. It is a little curious to notice that the latter for a day or two stood higher in the market than the deferred stocks of the Great Northern and the South-Eastern companies, both of which have been in receipt of dividends for many years, whereas the District Company has paid, of course, only one dividend during the last four decades.

The return to more normal conditions in the Stock Exchange will be introduced by the reinstitution of fortnightly settlements, and by the permission given to start contango business again, which will come about as a result of the action of the Stock Exchange Committee on Monday in this week. Strenuous opposition has been offered to the re-establishment of contangoes which, it is contended, will open the door to waves of speculation unhealthy to the markets and dangerous to the community. The system of cash dealings under which the Stock Exchange worked throughout the war did good service as an emergency measure, but it has outgrown its usefulness, and the handicaps which it imposes upon freedom of dealing are thrown into sharper relief week by week. The official end of the war was announced at the end of last August, so that there are still a few months to run before the pre-war liabilities must be compulsorily cleared up. The Stock Exchange Committee has gone ahead of time, and the result is likely to prove beneficial so long as members of the House will refrain from encouraging business of a dangerous description.

The remarkable success which attended the issues of the Calcutta Electric and the Indian Electric Supply companies, details of which were given here last week, shows how eager is the investment demand on the part of the public. There is some talk, indeed, of a further reduction in the Bank Rate, and this impression may possibly have something to do with the success that most of the new issues score. Be that as it may, the lists of the two issues just mentioned were open for a very short space of time, and allotments of the Calcutta were on a modest scale. Those in the Indian Electric Supply company are not out yet. Meanwhile, the older stocks are well held at their previous premiums, and the success of the Calcutta debenture led to the price of the ordinary shares rising to 4¾, the 5 per cent. preference hardening to 3¾. Calcutta Electric Supply ordinary shares are better at 23s. 3d.

Electricity supply shares generally are a good market, though in one or two cases the best prices recently touched have given way to a more moderate level. From this, the inference may be reasonably drawn that the rise in prices has tempted a few shares to market. Charing Cross ordinary, however, are 5s. higher at 6½, and the preference at 3¾ show ½ rise. Smithfields are good at 3. South Metropolitan preference at 1 3/16 are 1/16 up. Westminsters rose to 7¼. City Lights eased off to 38s. Of the more recent issues, Jutland Telephone 5½ per cents. at 100¼ are 7½ premium, and Metropolitan Railway 5 per cent. preference has gone back from the top, standing now at 9 premium. North Metropolitan Electric Power second preference, with £65 paid, is quoted 3 premium, and Whitehall Electric Investment preference remain at 18s. 6d., the debentures, which came out at 87½, now commanding a few shillings premium. Yorkshire Electric 6 per cent. preference, which subscribers obtained at £4, are now 5. The Castner-Kellner Co. has declared a dividend at the rate of 8 per cent. actual for the past six months.

Something of a sensation has been caused by a dramatic rise in Marconi's shares. The Postmaster-General's enthusiastic support of radio-telephony drew immediate attention to Marconi shares, and from 50s. the price sprang to 56s. 3d., with scarcely a look-back. Speculation is active in the market, and the shares of some of the subsidiary companies followed the rise of those in the parent undertaking. Marines are 5s. higher at 35s. Radios are rather firmer at 24s. 3d., the preferred remaining at 15s. For Automatic Telephones there has been a little inquiry, and shares have been done lately at 10s. 9d. International Automatics changed hands the other day at 7s. 3d., the company's preference being quoted at 15s.

British Aluminiums have been an active and a rising market. The price rose as high as 18s. 6d., and the nominal middle

price of 17s. 6d. shows a rise of 1s. 3d. on the week. English Electrics are similarly better at 15s., and the preference improved to 18s. 3d. Siemens have come into further demand, owing to the report and the maintenance of the 10 per cent. dividend; the price advanced to 28s. 9d., while General Electrics are steady, Cromptons 6d. lower, and Edisons unchanged. The cable manufacturing group is firm as a whole, the movements being confined to small fractions this week.

Anglo-Argentine Tramways first preference have taken on a little fresh animation, and are better at 3 11/16; the 5 per cent. debenture at 83½ is a point down. In Mexicans the tendency, for the time being, is inclined to be dull, although Mexico Tramways 5 per cent. bonds are an exception. British Columbia Electric stocks failed to show recovery from their decline of last week, the preference issue, however, still being wanted. It is worth noticing that the Indian group of traction and supply shares exhibits a better tendency than has been noticeable for some time past. Apparently India is settling down again, and the declines which occurred in a good many of the Indian industrial shares have not passed unnoticed by the investor.

The rubber market, it is becoming almost monotonous to say, is as dull as ever. Raw rubber is back to a shade below 8d. a lb., but in spite of the weakness of the material, a number of the good companies show in their recent reports that they can keep going without difficulty under present conditions, though profits, of course, are very moderate. The iron and steel group, together with armament and engineering shares, still waits on the lock-out in the engineering trade. To the onlooker, the surprising part about this is the calm way in which both sides appear to accept a position which appears to be so ruinously expensive.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend. 1920.	Dividend. 1921.	Price May 16, 1922.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	7½	—	£8 0 0
Charing Cross Ordinary	8	9	6⅜	+ ⅛	6 18 6
do. do. do. 4½ Pref.	4½	4½	3⅞	+ ⅛	6 0 0
Chelsea	6	6	5⅝	—	6 6 8
City of London	14	14	38/-	-9d.	7 7 4
do. do. 6 per cent. Pref.	6	6	22/6	—	5 6 8
County of London	8	8	1½	—	6 8 0
do. do. 6 per cent. Pref.	6	6	1	—	6 0 0
Kensington Ordinary	9	10	6⅜	—	7 11 0
London Electric	5½	4	1⅝	—	7 6 10
do. do. 6 per cent. Pref.	6	6	4⅝	—	6 9 9
Metropolitan	7	8	5½	—	6 16 7
do. 4½ per cent. Pref.	4½	4½	3⅞	—	6 0 0
St. James' and Pall Mall	12	12	8½	—	7 5 5
South London	7	7	5½	—	8 0 0
South Metropolitan Pref.	7	7	1⅛	+ 1/16	5 18 0
Westminster Ordinary	10	10	7½	+ ⅛	6 18 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	109½	— ½	5 17 1
do. Def.	1½	34/6	24½	+1½	7 2 6
Chile Telephone	6	6	6½	—	4 16 6
Cuba Sub. Ord.	7	7	8½	—	8 4 8
Eastern Extension	10	10	19⅜	—	5 3 3
Eastern Tel. Ord.	10	10	194½	—	5 2 10
Globe Tel. and T. Ord.	10	10	19½	— ½	5 4 0
do. do. Pref.	6	6	11⅜	— ⅛	5 7 0
Great Northern Tel.	23	24	31	—	7 14 0
Indo-European	10	10	40½	—	6 8 5
Marconi	25	15	2⅞	+ 1/16	5 6 9
Oriental Telephone Ord.	12	12	23	—	*5 1 1
United R. Plate Tel.	8	8	7½	+ 1/16	*5 6 8
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	19⅜	—	*5 3 3
Home Rails.					
Central London Ord. Assented	4	4	68	+1	5 17 8
Metropolitan	1½	2½	45	—	5 6 0
do. District	Nil	1	38½	+3½	2 11 9
Underground Electric Ordinary	Nil	Nil	2½	+ ⅛	Nil
do. do. "A"	Nil	Nil	7/-	+6d.	Nil
do. do. Income	2	4	80½	+3	*4 19 5
Foreign Trams, &c.					
Anglo-Arg. Trams. First Pref.	5½	12½	81½	+ 1/16	7 8 6
do. do. 2nd Pref.	Nil	5½	4	—	6 17 6
do. do. 5 per cent. Deb.	5	5	83½	-1	5 19 9
Brazil Tractions	Nil	Nil	49	— ¼	Nil
British Columbia Elec. Rly. Pfcs.	5	5	86½	+ ½	5 4 8
do. do. Preferred	5	99/-	71½	—	*5 9 6
do. do. Deferred	3	194/-	71½	—	*3 7 6
do. do. Deb.	4½	4½	73	—	5 16 5
Mexico Trams. 5 per cent. Bonds	Nil	Nil	71½	+1	—
do. do. 6 per cent. Bonds	Nil	Nil	80½	—	Nil
Mexican Light Common	Nil	Nil	2½	—	Nil
do. Pref.	Nil	Nil	54	—	Nil
do. 1st Bonds	Nil	5	74½	—	6 14 3
Manufacturing Companies					
Babcock & Wilcox	15	16	8	—	5 6 8
British Aluminium Ord.	10	10	⅞	+ 1/16	—
British Insulated Ord.	15	15	2⅛	+ 1/16	7 5 3
Callenders	15	15	2⅛	+ 1/16	7 7 9
,, 6½ Pref.	6½	6½	1⅛	—	5 9 5
Crompton Ord.	10	10	22/-	-6d.	9 1 10
Edison-Swan	10	—	5/-	—	—
do. do. 5 per cent. Deb.	5	5	64	—	7 16 4
Electric Construction	10	10	1½	—	6 0 0
English Electric	8	8	15/-	+ 1/16	6 13 4
do. Pref.	6	6	18/8	+9d.	6 11 6
Gen. Elec. Pref.	6½	6½	22/9	—	5 14 3
do. Ord.	10	10	28/-	-3d.	8 18 10
Henley	15	15	2⅛	— 1/16	7 5 3
do. 4½ Pref.	4½	4½	4⅛	—	5 4 4
India-Rubber	10	—	⅜	—	—
Met.-Vickers Pref.	8	8	2½	—	6 8 0
Siemens Ord.	10	10	1⅛	+ 1/16	*6 19 2
Telegraph Co	20	20	36	—	*4 12 6

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, May 17th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic per lb.	8d.	½d. dec.
a Ammoniac Sal per ton	£65	..
a Ammonia, Muriate (large crystal) ,,	£58	..
a Bisulphide of Carbon ,,	..	..
a Borax ,,	£30	..
a Copper Sulphate ,,	£27 10s.	10s. inc.
a Potash, Chlorate per lb.	6d. to 5½d.	..
a ,, Perchlorate ,,	7½d.	..
a Shellac per cwt	£18 15s.	10s. dec.
a Sulphur, Sublimed Flowers ,,	£13	..
a ,, Lump ,,	£11	..
a Soda, Chlorate per lb.	3½d.	..
a ,, Crystals per ton	£7	..
a Sodium Bichromate, casks per lb.	5½d.	..
METALS, &c.		
b Aluminium, Ingots per ton	£120	..
b ,, Wire per lb.	1/9 to 2/6	..
b ,, Sheet ,,	1/6 to 2/-	..
p Babbitt's Metal and Anti-friction Metal—		..
Grade I per ton net	£147	..
Grade II ,, ,,	£106	..
Grade III ,, ,,	£62	..
c Brass (rolled metal 2" to 12" basis) per lb.	8¾d.	..
c ,, Tubes (solid drawn) ,,	11¼d. to 11¾d.	..
c ,, Wire, basis ,,	9¾d.	..
c Copper Tubes (solid drawn) ,,	1/1½	..
c ,, Bars (best selected) per ton	£88	..
c ,, Sheet ,,	£88	..
c ,, Rod ,,	£88	..
d ,, (Electrolytic) Bars ,,	£68 5s.	25s. inc.
d ,, ,, Sheets ,,	£146 10s.	..
d ,, ,, Wire Rods ,,	£78 5s.	25s. inc.
d ,, ,, H.C. Wire per lb.	10⅞d.	½d. inc.
f Ebonite Rod ,,	5/6	..
f ,, Sheet ,,	8/-	..
n German Silver Wire ,,	2/6	..
h Gutta-percha, fine ,,	12/6	..
h India-rubber, Para fine ,,	10½d.	½d. dec.
l Iron Pig (Cleveland Warrants) per ton	90/-	..
l ,, Wire, galv. No. 8, P.O. qual. ,,	£27	..
g Lead, English Pig ,,	£25 5s.	5s. inc.
g Mercury per bot.	£10 15s. to £11	..
e Mica (in original cases) small per lb.	3d. to 3/-	..
e ,, ,, ,, medium ,,	4/- to 8/-	..
e ,, ,, ,, large ,,	10/- to 20/- & up	..
p Phosphor Bronze, plain castings ,,	1/1	..
p ,, ,, drawn bars and rods ,,	1/3	½d. dec.
p ,, ,, rolled strip & sheet ,,	1/2½	1½d. dec.
p ,, ,, Wire ,,	1/6½	½d. inc.
o Platinum ,,	£19 10s.	..
d Silicium Bronze Wire per lb.	1/1	½d. dec.
r Steel, Magnet, in bars ,,	1/-	..
n Tin, Block (English) per ton	£149 to £150	20s. dec.
n ,, Wire, Nos. 1 to 16 per lb.	8/-	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Instructional Courses for Teachers of Engineering Science, &c.—If the number of suitable applicants is sufficient, the Board of Education will provide during the summer courses of instruction of two weeks' duration for teachers of engineering science and electrical engineering in technical schools. The standard of the work will be that of the "National Certificates" in engineering of ordinary grade, but advanced treatment will be accorded to certain sections of the work. The courses will start on July 22nd, and will end on August 5th. The courses will be held in Oxford, in the University engineering building, the University electrical laboratories, and in the new laboratories of the City of Oxford Technical School. The instruction in engineering science will be given by Professor F. C. Lea, D.Sc., of Birmingham University, and that in electrical engineering by Professor W. M. Thornton, D.Sc., D.Eng., of Armstrong College, University of Durham, each of whom will have the assistance of a staff of tutors, lecturers, and instructors. Teachers who wish to apply for permission to attend either course must fill up and return Form 972 T Engineering as soon as possible, so as to reach the Board's office not later than May 29th. Teachers in schools working under the Local Education Authority must obtain the forms and return them through the Local Education Authority.

Post Office Examination.—The Secretary, Civil Service Commission, Burlington Gardens, W.1, announces that an examination of candidates for appointment as inspectors in the Engineer-in-Chief's Department of the G.P.O. will take place shortly. All applications should be sent in by June 8th: applicants must be between the ages of 17 and 22.

HIGH-SPEED WIRELESS TELEGRAPHY.

By Lieut.-Col. A. G. T. CUSINS.

[*Abstract of paper read before the* Wireless Section of the Institution of Electrical Engineers.

This paper consists in the main of a record of experimental progress directed towards the mechanicalisation of wireless telegraphy in as simple and portable a form as possible.

The recent International Conference in Paris disclosed the disquieting fact that the ether is already in danger of being overcrowded.

Even taking into account the refinement which has been attained in selectivity, that is to say, in reducing the percentage difference in frequency at which two simultaneous messages can be received conveniently, and allowing full credit to the progress made in directive working both in transmission and in reception, even then the gamut of frequency over which operation is possible is very limited, and between the upper and lower limits, say from 6,000,000 to 6,000, or in wave-lengths from 50 to 50,000 metres, choice is

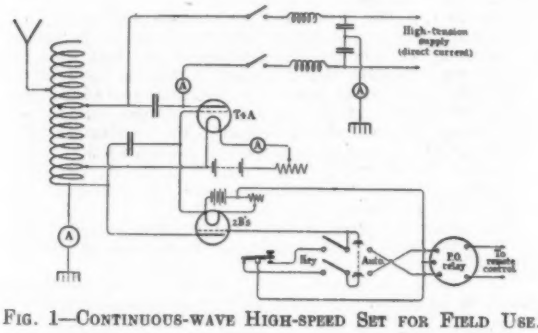


Fig. 1—Continuous-wave High-speed Set for Field Use.

further limited by the interdependence between the three factors: power, frequency, and distance. As the mutual interference between very large stations becomes more marked, it is possible that they will tend to be limited to operations over ocean tracts where distance is the deciding factor.

Over shorter distances it is suggested that the practice will arise of installing medium-power stations with a more limited area of operation and relaying traffic from one to another. Such a system, employing a geographical method of distribution of wave-lengths so as to minimise interference should be very elastic and capable of expansion. In order to make

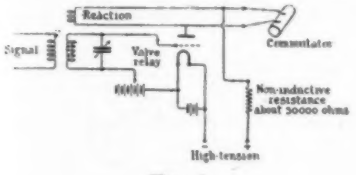


Fig. 2.

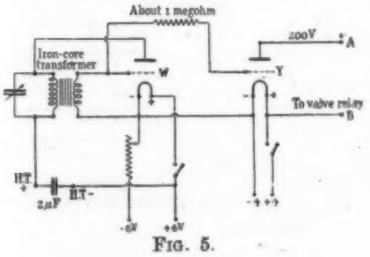


Fig. 5.

full use of such a system, however, it is imperative that it be used economically by combining selectivity of reception and speed of operation; and in speed of operation must be included facility of relaying from and to adjoining stages of either wired or wireless communication.

It is such a system that is here brought forward. In its actual form it is necessarily of a "semi-portable" type, that is, that the work of installation, dismantling and transport is such as could be undertaken by the Signal staff of one of the larger Army formations, a corps for instance. In the less cramped circumstances of commercial working in peace time there seems to be no reason why it should not be brought to a very high degree of refinement and efficiency.

Transmission.—To transmit signals at high speed in the field complicated mechanisms are out of the question. We are now able to use the Wheatstone, on sets up to 6 kW, with an ordinary single-current key straight into the circuit without any intermediate mechanical device.

For remote control, whether at hand or high speed, the key is replaced by a Creed relay. The action is practically sparkless, in spite of the fact that the high-pressure voltage reaches 9,000 volts.

However, for the small sets, of about 2 kW, now working between Aldershot and Cologne, trial was made of utilising the anode-filament path of a small "control" valve as the grid leak of the main generating valve. By operating on the grid-filament circuit of the control valve, the resistance of its anode-filament path may be varied enormously, and the

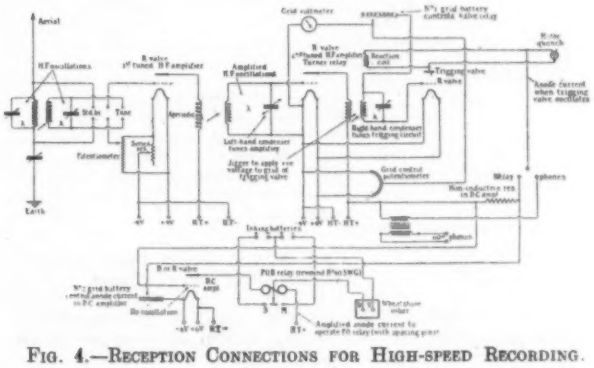


Fig. 4.—Reception Connections for High-speed Recording.

oscillations of the main generating valve be controlled instantaneously over their full amplitude. So delicate is this method of control that it is easily possible, using an ordinary Post Office Wheatstone transmitter, unaltered, to close the grid-filament circuit of the control valve when a signal is required to pass, and to apply the requisite negative pressure to the grid and so check the oscillation of the main generating valve during the spacing period. This action is to all intents and purposes instantaneous; in fig. 1 the actual Wheatstone instrument is at a distance from the transmitter, the signals being relayed to the latter through a Post Office relay. This allows of the sending of a message from an office at any desired distance from the wireless transmitting station, passing the message from wire to wireless without intermediate

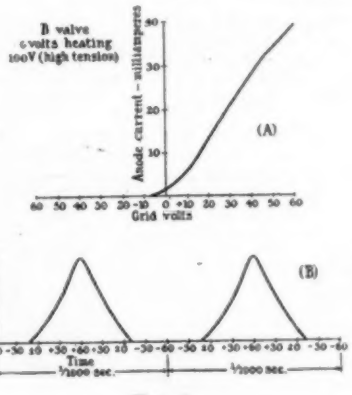


Fig. 6.

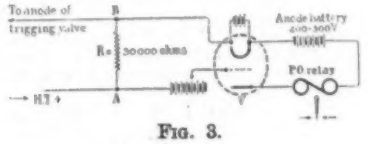


Fig. 3.

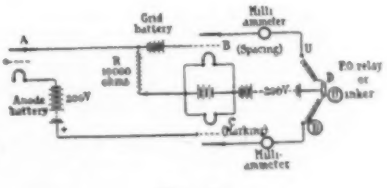


Fig. 7.

re-transmission, and enables the sending instrument, key or Wheatstone, to be in the same office. The system goes by the name of "remote control," and opens up possibilities of duplex working.

The actual set at Aldershot which is now working to Cologne, operates on an aerial consisting of two 300-ft. wires between 70-ft. masts; earth resistance, 6 ohms; aerial current, 10 to 12 amperes. It has actually been the case that an important message, which had repeatedly failed to get through by hand transmission and aural reception, owing to atmospheric disturbance, was successfully handled at high speed with automatic reception.

The Post Office has been conducting trials of this somewhat under-powered set, and traffic between London and Germany has been carried on a single wire and earth between

the Central Telegraph Office, London, and Aldershot, then from Aldershot to Cologne by military wireless, and from Cologne military wireless station to the German Post Office by wire. Through transmission has also been carried on with a certain amount of steady success, using Wheatstone transmission and Creed printer reception, the working speed being 100 words a minute.

Reception.—Loop reception for small and medium-sized stations allows of the transmitter being placed at such a point as will cause a minimum of interference while still maintaining maximum efficiency on the line of direction of reception; recent experiments have resulted in the reduction of such interference to a most remarkable degree.

There is a point below which an unaided signal fails to operate a detector, and to cause a detector valve to "rectify" it is necessary to intensify the signal frequency. A really satisfactory tuned high-frequency amplifier was evolved which was found to be extremely stable. It gives an amplication

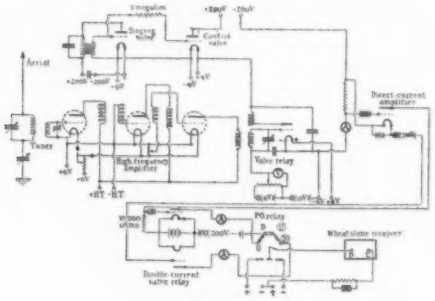


FIG. 8.

factor of about × 750 on three valves, with a 3 per cent. factor of selectivity, *i.e.*, a reduction of signal strength to 30 per cent. of the maximum is brought about by a 3 per cent. variation of wave-length. Such an instrument is a very important addition to any system of reception when selectivity is desired.

With regard to the "trigger" relay an important point to realise is that the reversal of the increment of grid potential which was sufficient to cause the valve to "trig," is not nearly sufficient to cause the oscillations to stop when once started. and satisfactory quenching is one of the most difficult features of the problem.

A high-speed quench could not be obtained by means of a magnetic relay in the anode circuit of the trigging valve. Therefore, a non-inductive resistance was substituted. Attempts were then made to short-circuit the anode reaction coil, thus providing a quench, by means of a rapidly revolving commutator (fig. 2) separated from the motor which was well removed from the valve relay, the drive to the commutator being by a long belt. A much greater improvement was produced by arranging the brushes on the commutator so that at any speed of rotation the duration of the short-circuiting period could be controlled.

To get a current corresponding to the incoming signals and large enough to operate a P.O. relay at speed, the non-inductive resistance of fig. 2 was connected to a valve B (fig. 3); R is of the order of 30,000 ohms. The grid of valve V is kept negative so that the current from the anode battery is very small.

When a signal is received the trigging valve oscillates and its anode current traversing R may then well be about two milliamperes. There is then a potential difference across R of 60 volts, A being negative with regard to B. Therefore, as long as the current (or signal) endures, the grid of V is raised by 60 volts above its normal voltage with respect to the filament, or becomes 60 volts more positive. This condition allows the anode current of V (which traverses the P.O. relay) to become very large and the relay is thus operated. The relay in this arrangement is re-wound with No. 44 S.W.G. wire.

A standard receiving set was then made up. Fig. 4 shows the receiving circuits; perfect records were obtained at 100 words per minute. By using a very loose coupling between aerial and closed circuit it was possible to receive through atmospherics. Later the quench again gave trouble and the origin was found to be the belt drive. It appeared to be due to some frictional effect between belt and driving pulley. The quenching commutator was again mounted directly on the motor and care taken to make it dead smooth. The brushes were also adjusted to make a very light contact on the rotating commutator, and these precautions finally disposed of the quenching troubles, which were after all not apparently attributable in any way to inductive effects from the motor. This arrangement then was taken to be the standard method for working reliably at 100 words per minute.

A standard receiving outfit was then taken to Cologne and the transmission arranged from Woolwich. The transmitting set was provided with 5,000 volts direct current, and the current obtained in the aerial was about 10 amperes. The wave-length was 1,700 metres. During these reception trials at Cologne the speed was raised to 150 words a minute and long Press extracts were successfully recorded.

The rate of quench (q) per second must be not less than the desired number of words per minute × 2.7. The use of a rotating commutator with brushes becomes very difficult at this speed, especially when frictional effects spoil the result and have, therefore, to be reduced to a minimum. Several electrical methods have been tried and fig. 5 shows the most satisfactory.

The method consists of supplying the trigging valve of the valve relay with high-pressure current in pulses and not continuously as previously. This will result in the trigging valve oscillating during only a portion of the time during which it is supplied with high-pressure current and in the oscillation fading out, or in other words, the quenching of oscillations, during the period when no current is supplied. The valve W (fig. 5) is caused to oscillate as shown at a suitable frequency, *e.g.*, from 1,000 to 3,000 per second. The valve Y is employed as a valve in the usually accepted sense. The grid of W is connected to the grid of Y through a large resistance. The filaments are directly connected. The result is that the grid of Y is made alternately positive and negative at the frequency of oscillation of W. The high-pressure supply for the valve relay is passed from A to B, *i.e.*, through valve Y from anode to filament. Therefore, when the grid of Y is sufficiently negative no current can be supplied to the valve relay. Fig. 6 makes the action clear.

Suppose A, B (fig. 5) to be joined to the positive and negative respectively of a 100-volt battery. Suppose the valve W is oscillating at 1,000 periods per second and that the energy is such that the grid of Y is caused to vary in potential from +60 volts to −60 volts, then if A (fig. 6) is the anode characteristic of valve Y, B of fig. 6 represents the current which the 100-volt battery would deliver. By adjustment of the frequency and energy of oscillation of W and by a permanent control of the potential of the grid of Y the curve B can be varied in shape at will and conditions established to obtain a satisfactory quench.

Quenching by means of this arrangement has been found to be satisfactory for all speeds of transmission of which the standard Wheatstone transmitter is capable.

The current to operate the P.O. relay was obtained as shown in fig. 3, but it is not a suitable arrangement for speeds much over 100 words per minute. The arrangement shown in fig. 7 was therefore devised.

The valve A is the direct-current amplifying valve shown in fig. 3. Its anode circuit, however, is modified as shown. The current from the anode battery now flows to the grid of valve C, thence to the filament, and thence by R (10,000 ohms) to the anode.

When valve A passes no anode current (no signal) the anode current of valve C (marking valve) is very small. The anode current of valve B (spacing valve) will, however, be large, since the grid of B is maintained positive by the grid battery. Hence a large spacing current will flow from D to U through inker or relay, with a relatively small marking current from U to D.

When a signal is received, these conditions are reversed. Milliammeters are inserted in the anode marking and spacing

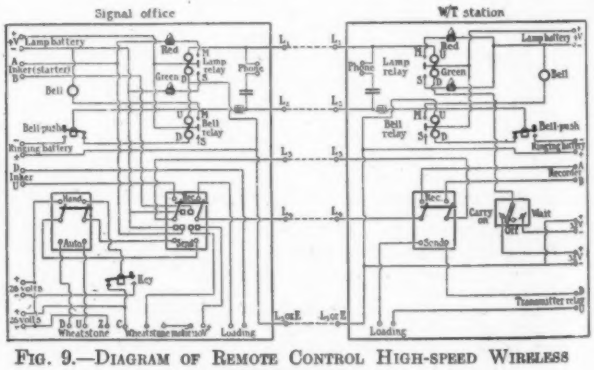


FIG. 9.—DIAGRAM OF REMOTE CONTROL HIGH-SPEED WIRELESS TELEGRAPHY.

circuits in order to allow of satisfactory balancing being obtained. In practice, when receiving a prolonged series of dots at high speeds these two instruments both read about 20 milliamperes. The actual value of current in each circuit varies by some 30 milliamperes, *i.e.*, from 10 mA to 40 mA according to whether a signal is being received or not. Although the relay or recording instrument is not actually supplied with double current, the effect is the same as that of a true double current of half the value. With this arrangement the Wheatstone receiver or P.O. relay can be made to operate at the fastest rate of the standard transmitter.

Fig. 8 gives the complete theoretical arrangement from aerial to recorder. All switches and the like are omitted for the sake of simplicity.

Although fig. 8 shows a Wheatstone receiver, a Creed receiver and printer have been successfully operated from the Post Office relay, thus enabling wireless messages transmitted at 10 words per minute to be received, printed in Roman characters, and ready for delivery with practically no delay.

The P.O. relay shown in figs. 3 and 4 may be replaced by a chemical inker. This consists in specially prepared paper drawn between a roller and a marking pointer, the pointer and roller maintaining continuous contact with the paper. The arrival of a signal causes a current to pass through the paper, causing a discoloration, the signal being recorded in the same form as with a Wheatstone recorder. The paper, which may be the standard Wheatstone slip, is prepared by passing it through a bath of potassium iodide solution. The paper when used is dry to the touch, but owing to the presence of a deliquescent salt contains sufficient moisture to enable a current to pass and produce a mark by liberation of iodine. Perfect signals have been obtained at 3,000 words per minute, but it is suggested that with the present apparatus a working speed of 1,500 words per minute with a marking current of 15 milliamperes is a working proposition.

Remote Control.—To be able to deal with the traffic at some point other than the site of the wireless station a system of remote control has been devised. Fig. 9 shows the arrangement.

The method of operation is as follows:—

Transmission.—The signal office makes the signal to the wireless station meaning "I want to transmit" by pressing the bell push once. The wireless station acknowledges by putting its control switch to "wait" (while the generator is started, valves lighted, &c.), thus showing a red light at each end. When the wireless gear is ready for transmission the wireless operator puts his switch to "carry on," thus changing the red light for a green one, and letting the signal office know that transmission may take place. The signal office now calls the distant wireless station by hand, and when about to send automatic sends a predetermined signal, for example, six M's. The signal office then goes over to automatic and runs slip.

Reception.—The normal position of both switches is at "receive." The wireless operator at the station (who is on watch) hears his call. He sends a warning signal to the signal office, conveying that automatic may be expected (*i.e.*, rings bell once). On hearing the pre-determined signal (six M's—upon the first of which he would act) the operator puts his control switch to "carry on," which action now starts the Wheatstone receiver in the signal office, and the signals are there recorded. Co-ordination is ensured by the fact that the red and green lights are identical in action at both ends and a direct telephone is always available.

All the apparatus described is of a type requiring to be tuned throughout to the incoming signal. This has been superseded by a type of self-quenching relay, which is set to a given frequency. The incoming signal is not applied directly, but through a frequency-changer, that is, the signal is heterodyned, and the heterodyne beat is adjusted to the frequency of the relay apparatus. This last, which is called the "Autakym," is not a true Turner trigger, in that the signal effects a change in the nature of the anode current of the trigger valve rather than of its value. As this device, once set, does not call for readjustment on variation of wave-length, and as the same heterodyne is used both for aural and automatic reception, it is a very handy instrument for use where reception may have to deal with working on a variety of wave-lengths, as might happen in the field.

Conclusion.—There can be no doubt that the direct recording on paper, and indeed printing, of wireless signals is now an accomplished fact. The speed at which it is possible to work is at least as great as the speed at which the Wheatstone apparatus itself will work, and, with a specially constructed transmitted and chemical inker, speeds of over 1,000 words per minute have been recorded.

Possibly little is to be gained at present for general utility purposes in pushing up the speed to more than about 100 words per minute. The need, however, for a printing-telegraph machine that can operate at, say, 300 words per minute from a Post Office relay is great, and the development of such a machine seems to be the determining factor in deciding the speed at which the wireless system shall operate.

Austrian Dynamo Works.—The Austrian Dynamo Works Co., of Vienna, reports that the production in 1921 was several times greater than in the preceding year. It is claimed that the undertaking is now one of the largest motor works in Austria, specialisation being made of the construction of small and medium-sized types of motors. It has been possible to open up a number of foreign connections, which have led to the receipt of considerable State orders and to association with foreign works producing benzine engines and agricultural machinery. The dividend is 20 per cent., as against 15 per cent. in 1920.

ROTARY CONVERTERS.

DISCUSSION AT NEWCASTLE.

AT a meeting of members of the NORTH-EAST CENTRE of the INSTITUTION OF ELECTRICAL ENGINEERS, at Newcastle-on-Tyne, Mr. F. P. WHITAKER submitted his paper upon the above subject, which was abstracted in our issue of March 17th.

Dr. W. M. THORNTON, who presided, opened the discussion by saying that the paper was really divided into two portions—flash-over, and telephone disturbances—and which of those was the more important was for the individual concerned to decide. Referring to flash-overs, he said there was a statement in the paper as to this being due to the copper vapour. They had made a good many experiments at the Armstrong College, and the result proved that it was due to carbon dust. The arc seemed to follow a fall in resistance, and it was much easier to get a flash-over with carbon dust than from copper vapour, unless indeed the "vapour" was really particles of copper. They got over the difficulty by the use of "wipers" on the surface of the commutators behind the brushes. That entirely stopped flashing. Unfortunately "wipers" were not a commercial proposition, although in the laboratory they presented no difficulty, and the action was perfect. The wipers did not wipe "vapours," but solid particles. How much the commutator had to "short" before it flashed over was an interesting point.

Mr. W. T. DALTON thought the author's figs. 5 and 6 represented machines that would be very suitable for automatic sub-stations, where there would be no one in attendance. As to regenerative braking, he was not sure but that some alteration would have to be made to the motors. As to rippling they had made many experiments with rotary converters, and certain improvements had been made which reduced the ripples to a very low figure. The question of interference with telephonic lines was an important one with the railways. Certain telephone systems were more sensitive than were others and one, the central-battery system, was particularly so, but he thought railways were in a better position than were the tramways, as the permanent way was insulated from the earth by the sleepers; consequently, he thought railways would be less subject to those disturbances than tramways.

Mr. TOWNEND spoke of the limitations of rotary converters as dealt with in the paper, and thought the electrical limitations as laid down were more fixed than were the mechanical limits. He did not think that the peripheral speed of 8,000 ft. per minute was too great. There was a reasonable prospect of a radial commutator solving the problem of getting 1,500 kW at 50 periods. He was very optimistic of the development of converter design. The speaker drew attention to the Storer arc suppresser, which had proved exceedingly satisfactory. He had seen the device applied, and it seemed difficult to say whether it stopped the flash or not. There was a tremendous report and a blaze, but there was practically no damage. He regretted that the author had said nothing about flash barriers; the idea was old, but it might be useful.

Mr. C. SYKES referred to his visit to Rugby, where a series of tests had been carried out on "shorts" on a 1,500-kW machine. What struck the speaker was the fact that there was no burning of the commutator. Before seeing that type of machine he had generally found that a rotary converter had, after a flash-over, to be shut down and another put into commission until the first had been cleaned and brushed down. Yet there were about 37 "shorts" put on the machine he saw and, apparently, it would have been possible to have put on many more before the machine would have had to be put out of commission. Two slight marks on the surface were all that could be seen, which suggested that the flame had been blown clear of the commutator, and broken on the projecting end of the commutator bars.

Mr. J. R. BEARD said that in the Newcastle district the problem had had much time devoted to it, and he thought it should be known that the machine was exceedingly satisfactory. It had been running for a considerable time, and it was a fact that the machine would clear short-circuits. Quite recently they had occasion to look into the wear of the commutator, and it must have had a thousand short-circuits, but in seventeen years it had only worn one-quarter of an inch, which meant 68 years for one inch! At that rate the life of the commutator would be as long as that of the winding.

Mr. H. B. POUNDER, referring to the same machine as the last speaker, said that he believed only three times in its life had the a.c. circuit passed on a flash at all, and on each occasion there was reason to believe that the d.c. circuit was at fault. He thought there was a great deal of misconception as to flash-over, and drew a diagram to show how, in certain instances, the flash-over was from the slip rings to the bed-plates.

Mr. H. W. CLOTHIER said it seemed that Mr. Whitaker was trying to solve the problem in the machine itself independently of the switchgear engineer; if that could be done it was the best course, but he did not refer to a high-speed circuit breaker. The speaker described a high-speed diverter switch which acted in the 100th part of a second.

Other points were raised by MESSRS. FAWSSETT, ROSEN, and MCLEAN, and the author replied to some of the points raised.

Discussion at Birmingham.

Mr. F. P. Whitaker read his paper before members of the South Midland Centre of the Institution of Electrical Engineers, and a discussion followed.

Mr. R. A. Chattock pointed out that Mr. Whitaker apparently put efficiency before reliability. Supply station engineers looked upon reliability as of the first importance, and he thought that railway engineers would adopt the same attitude. With reliability was wrapped up simplicity—both as regarded the installation and the operation of it. He was convinced that it was better to sacrifice one per cent. or one-and-a-half per cent. of the efficiency if greater reliability and simplicity of operation were thereby obtained.

With a periodicity of 50, the maximum d.c. voltage that could be generated in a rotary converter with a single commutator was only 1,000, whereas with a periodicity of 25 it was 2,000. It seemed that was a very important point in favour of 25 periods compared with 50, because with double the voltage the number of sub-stations required would be very considerably reduced. Running two rotary converters in series seemed to detract very seriously from the important requirement of simplicity of operation—especially for automatic operation of sub-stations, which was practically a necessity in view of the heavy cost of the labour that would be required in a number of non-automatic sub-stations.

As regarded the use of high-speed circuit breakers, it seemed that with so much rotating plant on the system (consisting of the motors on the trains as well as the rotary converters themselves) there must be a risk of high-voltage surges being caused when the breaker opened, due to self-induction.

Automatic sub-stations would be a necessity for railway work, and it was evident that the initial cost of an automatic rotary equipment was about double the cost of the ordinary equipment. That would militate against the adoption of rotary converters when comparing their use with the mercury arc rectifier, as it was quite possible to make the operation of the latter automatic with very little extra expense.

Mr. Forrest pointed out that 1,500-volt rotary converters fitted with means for projecting the arc or flame away from the commutator in the event of a short circuit occurring, would be dangerous to approach when running on load. It would be highly dangerous for an attendant to feel or examine the bearing at the commutator end in case a short circuit came on whilst he was doing so. The mercury vapour rectifier was a much more desirable sub-station unit for high-voltage traction purposes. The maintenance of the proper vacuum was undoubtedly a problem, but high-vacuum pumps were now brought to a high pitch of perfection. The cost of a fully-automatic rotary-converter sub-station equipment was at present far too high; the cost of a 300-kW rotary-converter unit arranged for automatic operation was almost exactly twice as great as that of the same unit arranged for manual control. As the automatic sub-station would generally only be called upon to run a few hours per day, it was essential that its capital cost should be kept down to a minimum, even at the expense of efficiency, so that even if mercury-vapour rectifiers were not ultimately chosen, it was possible that railway engineers might install simple induction motor-generators in sub-stations arranged for automatic control.

Mr. F. W. Carter was of the opinion that the rotary, within its limits, was still foremost among sub-station units, and showed no sign yet of yielding to any rival, but it was doubtful whether railway engineers generally would be prepared to follow the author's ultimate limits of voltage and frequency. The rotaries Mr. Whitaker mentioned were generally 6-phase ones, but the 12-phase rotary could, equally with the 6-phase one, be run from a 3-phase circuit. At unity power factor the latter had a smaller armature loss, whilst the loss in the coils next to the taps was greater than the mean of that in the 12-phase rotary. Moreover, the reactance voltage was more uniform, so that the conditions for commutation were better. Against those advantages must be set the disadvantage of having 12 slip rings instead of six.

Dr. M. Kahn assumed a machine protected by a d.c. circuit breaker (not of specially high speed) and with the a.c. breakers set with time limits, so as to avoid the delay due to starting and synchronising the rotary after it had been cut off the a.c. supply, and stated that an overload thrown suddenly on to the machine (due to the rapid rise in current) caused deceleration of the armature, so that a considerable part of the energy given out on the d.c. side was supplied by the moving masses of the armature and not in the form of a.c. energy, *i.e.*, the a.c. did not rise anything like as rapidly as the d.c. The commutating poles of rotary converters had to be adjusted to suit permanent running conditions, when the alternating and direct currents in the armature were practically balanced, and the armature reaction was comparatively small. Under the transient conditions of short circuit, when the d.c. armature was not balanced by a corresponding a.c., the armature reaction was greatly increased and the commutating poles were practically put out of action, which led to violent sparking unless special precautions were taken.

It was possible that no actual flash over took place while the "short" was on the machine. As soon as the d.c. circuit breaker opened, the copper vapour enveloping the commutator would act as a conductor between the brush arms, and cause a flash over.

A contributing factor was the unbalancing of alternating and direct currents in the armature in the opposite direction to the one described above.

The phenomenon was akin to hunting, and flash-overs might occur in rapid succession until the machine was cleared on the a.c. side. The explanation showed the great importance attached to the fan mentioned in the paper which blew away the copper gas as soon as it was formed round the commutator. Magnetic blow-outs and flash guards were, of course, valuable further safeguards.

Prof. Cramp thought the paper demonstrated that the rotary converter was very ill-fitted for railway work. The author omitted all mention of the transformers and their connections, which were an essential part of the equipment. For instance, if the efficiency and power-factor curves did not include the transformers, the maximum efficiency obtained would not be very high when transformer losses were allowed for, although the general characteristics of the machine shown in the curves were very good. A distinction should be drawn between telephone disturbance due to ripples on the a.c. mains and those due to the d.c. feeders. In this country it was proposed for railways to use underground a.c. cables, which would obviate the former, and the latter could be avoided by reactance on the d.c. side. That would have a secondary beneficial effect, viz., that on short circuit the interpoles would be more effective, since the a.c. supply current and its armature reaction would be more nearly in phase with the current changes on the d.c. side. Experiments at the Birmingham University showed that the ripples on the tramway supply system due to the converter commutators were negligible when compared with telephone disturbances set up by the tramcar motors, and that would be more pronounced in railway work where the motors were relatively so much larger. Those disturbances were probably due quite as much to tooth flux as to any other cause.

Major A. M. Taylor congratulated the author upon having made progress distinctly in advance of what had been achieved in America. Mr. Whitaker was on the safer line in not depending exclusively upon external control, because the flash-over could take place across the commutator (and in fact did so) after the external switch had operated. 1,500 volts was hopelessly inadequate for main line electrification; 6,000 should be aimed at, but in default of that 3,000 might be passably efficient.

With 1,500 volts and allowing 2,000 kW per train, main line electrification from London to Birmingham to give present services would require an expenditure of something like £600,000 on rotary converters and transformers alone, as against some £20,000 for static transformers in the sub-stations, if single-phase locomotives were employed running at, say, 11,000 volts and 25 periods. It had been urged that a supply to such locomotives was impracticable at low cost, but from any 25-period station it would be practicable to supply from unaltered generators (*i.e.*, direct from the main busbars of the station) and by suitably sectionalising the line three-phase step-down transformers could each take up three successive sections of line, thus loading up the phases equally. In 50-period stations there was no reason why a second alternator designed for half the frequency should not be carried on the same shaft as that for the full frequency (59 periods).

Mr. F. P. Whitaker, in reply, said that whether one or two machines would be used to supply 1,500-V d.c., 50-cycle, a.c. would depend on the factor of safety that could be obtained in the design and construction of such machines, and he was of the opinion that at the present stage a greater margin could be obtained by installing two machines in series, and without higher first cost or sacrifice of efficiency.

A great deal could be done by speeding up the mechanical operation of breakers, but it was not advisable to go too far in increasing the speed of break of the arc. His curves covered the performance of the rotary converter set, including transformers.

The mercury arc rectifier was not as simple as the rotary, especially when large sizes had to be dealt with. The d.c. voltage was not so uniform and free from undulations as that of the rotary. The d.c. voltage regulation was poor, necessitating larger voltage ranges on the line and equipments. The h.p. power factor was low, and the a.c. current wave shape on the h.p. side was poor. Also the time taken to start up a spare equipment made it rather unsuited to traction requirements.

Discussion at Glasgow.

At the sixth ordinary and annual general meeting of members of the Scottish Centre of the Institution of Electrical Engineers (the last meeting of the 1921-22 session) that was held at Glasgow on April 11th, Mr. E. T. Gosling, Chairman of the Centre, presiding, Mr. Whitaker's paper was read.

In the course of the discussion that followed Mr. G. G. Braid dealt with the conditions under which rotaries operated

in traction service. He explained that for tramway service large temporary overloads and short-circuits were very frequent and instanced a personal experience of a station in which about 100 short-circuits occurred per day. He then dealt with the question of ripples, and stated that the actual ripples produced by converters had been reduced to very small magnitude, and did not exceed from ½ to 1 per cent. of the d.c. voltage. The mercury-vapour rectifier would be much worse than the rotary in this respect.

Mr. A. P. Robertson referred to the great advantage arising from keeping machines in on the a.c. side after a short-circuit had occurred. With a high-speed breaker the d.c. side could be quickly cleared without opening the a.c. switch, and so whenever the fault was cleared the machine could be put back into the d.c. circuit with very little delay.

Mr. A. E. McColl was inclined to doubt the wisdom of taking for granted that railways would be operated by d.c. at all, and instanced the fact that the Swiss Government was definitely committed to a.c. No selective action was obtained by circuit-breakers when faults occurred close to the supply station. Mr. McColl also referred to a case in which a rotary converter designed by Mr. Whitaker had given rise to trouble on the telephone system.

Mr. G. M. S. Sichel dwelt chiefly on commutation and instanced defects that arose in practice when using diverters in parallel with the interpole windings. Would a 6-phase rotary converter, fed through a Scott-connected bank from a 2-phase supply, be likely to give rise to commutation troubles? He had had experience with such rotaries which showed a tendency to flash over whenever the least disturbance occurred on the d.c. side. Mr. Sichel also spoke of an American device for short-circuiting the slip-rings through a reactance when excessive overload occurred on the d.c. side of rotary converters. The object was to reduce the short-circuit current in the transformer and allow the arc which developed at the brushes to clear, thus avoiding excessive transformer stresses or damage to the commutator slip rings and brushes. In conclusion, he thought it was a mistake to allow excessive currents, of the order of from five to ten times full load, to be taken from a machine under any circumstances and instanced the conservative policy of boiler makers on the question of overload.

Mr. W. J. Belsey dealt with the necessity for designing apparatus specially for the job on which it had to be utilised, and spoke of the necessity for manufacturers to look well ahead and to carry out experiments and development work to meet any conditions that might come along.

Mr. James Anderson was specially interested in the application of anti-friction ball or roller bearings to electrical machines.

Mr. J. Henderson spoke as a manufacturer of motor converters, rotary converters, and motor generators, and stated that reliability should be the first consideration, especially where automatic operation was being considered. He agreed with Mr. Whitaker that the average voltage between commutator segments should be low, but stated that higher pressures than 13 volts quite often had to be used. He put the maximum commutator speed at 6,000 ft. per minute. He was of the opinion that the advantages of having single units, smaller floor space, and greater reliability, were all on the side of the motor converter. For 3,000 volts direct current Mr. Henderson recommended the use of two 1,500-V. d.c. motor converters. Mr. F. P. Whitaker, in reply, stated that the circuit breakers broke circuit in about one two-hundredth of a second, but that figure was given with reservation; the use of a high-speed breaker with a badly designed machine would not improve matters much. The conditions were very different in England from those prevailing in Switzerland, and while a.c. might be suitable for the latter country, it was much less suitable in Britain. With regard to ball and roller bearings, the gain in efficiency due to their use was of the order of from .1 to .15 per cent., and so far as his experience had gone they were not successful on rotary converter work. The device referred to by Mr. Sichel for diminishing the effects of short-circuits seemed to Mr. Whitaker to be crude and of little value.

Token-working on Single-line Railways.—In a paper read recently before the Institution of Railway Signal Engineers, Mr. W. S. Roberts said that in token-working on single-line railways the endeavour should not be to totally eliminate the human element, as the best apparatus would occasionally go wrong. Methods were suggested for preventing the recurrence of such an accident as that at Abermule in January, 1921. The token-delivering apparatus might be so arranged that the station official would have to put the starting signal at "Danger" before releasing a token; obtain the actual token before he could lower the starting signal; either (*a*) replace the starting signal before the train could be "belled" on, or (*b*) replace the signal before another token could be obtained; and replace the starting signal to "Danger" if the train for which it was lowered was cancelled. The train officials would have four safeguards, all of which would have to be ignored before an accident could occur. Further developments of the scheme were described and the switching system was explained.

THE ELECTRIC LIGHTING AT THE THEATRE ROYAL, DRURY LANE.

Not the least important of the improvements effected in the rehabilitation of the Theatre Royal, Drury Lane, is the scheme of lighting carried out by the architects, in conjunction with the General Electric Co., Ltd. The fittings themselves, illustrations of some of which we reproduce here-

Fig. 1.—Main Auditorium Fitting.

with, are splendid examples of modern workmanship. They are executed in the "Early Empire" style, characteristic of the interior decoration of the theatre.

The auditorium is illuminated from the ceiling by a central fitting and five smaller ones of similar type. The main fitting

Fig. 2.—Bowl Pendant for Corridor.

(fig. 1) is arranged for 30 lights, is 8 ft. in diameter, and weighs 15 cwt. It consists of a large upper corona surrounded by six 3-light flambeau brackets, a lower corona completing a panelled basket, the whole being carried out in cast brass finished in a rich dark ormolu judiciously relieved with blue

enamel enrichment. The panels are glazed, with heavy cut plate glass, and the fitting is completed by a lower cut glass bowl. The five subsidiary fittings are of similar design, but are without the upper corona and brackets. Numerous two-light flambeau brackets on the box and circle fronts give additional illumination to the auditorium, and between the boxes are installed four large standards on black marble bases with ormolu enrichment. In the boxes, bowl pendants finished dark ormolu and blue, with silk cord suspension, and "Equiluxo" glassware are installed. Ceiling fittings of the same type provide the main illumination for the circles, and are supplemented by three-light flambeau brackets applied to the front of decorative pilasters. The main entrance contains a central gilt electrolier with cut plate glass panels and bowl and six outside arms carrying pendant lights. On the staircase flambeaux lights are fitted. Fig. 2 shows the bowl pendant used in the corridors.

The whole of the electric light fittings for the theatre were designed and manufactured by the General Electric Co., Ltd., and in addition to the main fittings already described, subsidiary fittings, such as "Exit" signs, ceiling fittings in lobbies, police light, &c., are included. The G.E.C. also supplied all the lamps and cables used in the theatre, "Osram" gasfilled and vacuum-type lamps being exclusively employed; the wires and cables were manufactured at the Pirelli-General works at Southampton.

We are indebted to the proprietors of the Theatre Royal for permission to publish this description.

ELECTRICAL NOTES FROM INDIA.

(From Our Special Correspondent.)

Mention has previously been made in these Notes of the power station which the Andhra Valley Co. has erected, and which will very shortly be in operation. Some details of the great work are available, and will prove of interest.

At the top of the Western Ghats, an artificial lake has been made, with a main dam 1,850 ft. in length and 190 ft. in height, with a thickness of 148 ft. at the base and 15 ft. at the top. This is situated at the south end; and a further small dam has been constructed along the western side. The outlet of the lake is at the end furthest from the main dam wall, nine miles away; and the static head of water on the Pelton wheels will be 1,750 ft. The maximum capacity of the lake is 14,484 million cb. ft., and the catchment area is roughly 48 square miles, and represents 110,000,000 cb. ft. of water per inch of rainfall. The average rainfall in the catchment area is 105 in. per annum, which falls wholly during the few months of the rainy season. At high-flood level, the lake will have an area of 125 sq. miles, and will vary in depth from 75 ft. at the tunnel entrance to 200 ft. at the main dam. The tunnel is about 9,000 ft. in length, with a 300-ft. channel, the whole of which has been blasted out of solid rock. Between the head works and the power station there will eventually be installed eight penstocks, but only two are receiving attention at the moment with the object of enabling two of the generators to be put into commission as soon as possible—in fact, it is hoped to be supplying from this station before the next monsoon. The main dam was designed by the late Sir Michael Nethersole, who, in the early days of the Andhra Valley schemes, was Tata's chief hydraulic engineer. It is situated where the valley narrows off considerably, for obvious reasons, and its spillway is equipped with automatic sluice gates. The gates remain closed until water commences to flow over the top of the spillway. Then, by a system of counterweights, operated by the overflowing water, the gates open, and remain so, until the water level is normal again, when, by their own weight, they close. The penstocks will be 4,800 ft. in length, with diameters of 42 in. in the upper section, and 38 in. below.

The power station proper is situated close up to the foot of the Western Ghats, and consists of two main buildings connected by a covered way; and of these, one houses the turbo-generators, the l.p. switchgear, and the control board; whilst the other contains the 5,000/100,000-V transformers and the h.p. switchgear, together with the outgoing line equipment. The whole of the switchgear is electrically operated from the control board. Six generators will be installed primarily, each of 10,000 kVA capacity, generating 3-phase current at 5,000 V and 50 cycles. This will be stepped-up to 100,000 V for transmission to Bombay, over copper lines upon steel tower structures, the route from Bhivpuri to Dharavi (the terminal station in Bombay) being *via* Chinchavli, Neral, Badlapur, Kalyan, Thana Creek, and Sion. There is a tie line, 17 miles long, from Bhivpuri to Khopoli (the Tata Hydro-Electric Co.'s power station), and a further tie between Parel (the Tata Hydro-Electric Co.'s terminal station in Bombay) and Dharavi, seven miles long.

The total length of transmission line is 80 miles. The incoming transmission-line energy will be transformed down to 22,000 V at the Dharavi receiving station, and there distributed to consumers' sub-stations, where there will be a further reduction to 2,200 V, 400 V, and 230 V.

Many of the large cotton mills in Bombay and environs are being equipped electrically, in preparation for the time when the Andhra Valley Power Co. is ready to supply. One of the most important of these is the Kohinoor Mills, Ltd., at Dadar which is being equipped by the B.T.H. Co., Ltd., with the necessary motors, switchgear, and general apparatus. Messrs. Mather & Platt supplied the electrical equipment for the bleaching department, but the whole of the erection is in the hands of the B.T.H. Co.'s local engineers.

After many years of postponement, the question of an electricity supply to the cantonments, city, and suburbs of Jubbulpore is a *fait accompli*, thanks to the solicitude of Sir Frank Sly's Government, and the laudable enterprise of a Bombay company, headed by Mr. Lallubhai Samaldas, C.I.E., a well-known industrial magnate. The contract for the entire installation of plant and wiring, together with the necessary distributing equipment, is in the hands of the Metropolitan-Vickers Electrical Co., Ltd. It is estimated that about two years will be required for the completion of the work. The Metropolitan-Vickers Co. has also secured a licence to supply electricity to the town and cantonment of Jhansi.

The Bombay Association of the Institution of Engineers (India) is contemplating the provision of a central meeting place, with the usual club facilities, for its members. Although formed only a few months ago, the membership of the Association is steadily rising, and the need for permanent headquarters is already felt. With a view to enabling the members to discuss the various papers which were read at the recent annual general meeting of the Institution of Engineers, the Association has arranged to hold a series of special meetings at the Bombay Mint. In this connection it may be noted that written contributions to the discussion will be welcomed, and will, if approved by the local committee, be forwarded to Calcutta for publication in the *Journal* of the Institution.

Recently, at the annual prize-giving of the Bengal Engineering College, Mr. B. Heaton, the Principal, stated that the most important event of the past year, so far as engineering education in India was concerned, had been the consolidation of the Institution of Engineers, a body which was formed to protect the interests, and to forward the well-being and professional efficiency, of Indian-trained engineers.

Another noteworthy feature of the past year had been the summoning of a conference of the principals of Indian engineering colleges, and of representatives of Indian Universities, to meet together at Simla and to discuss the position of Indian engineering colleges, and problems concerning the training of engineers for Government service that had been dealt with by the reports of the Royal Public Service Commission, the Indian Industries Commission, the Public Works Re-organisation Committee, and the Calcutta University Commission, all of whom had visited the Engineering College and commented on the methods of training. Such a conference was long overdue, and a committee appointed by the Bengal Government to consider the recommendations of that conference was now sitting.

With regard to the training of electrical and mechanical engineers, there had been progress; and the Government had decided to forge a close link between the practical training available in the workshops of the Presidency and the technical training given in the electrical and mechanical engineering classes of the College. It had appointed a Board to control apprenticeship training and to look after the classes. The Board had formulated a syllabus for an admission examination for pupils wishing to take up workshop apprenticeship.

The President, in the course of his address, said that the Government of India was anxious to do all in its power to provide facilities for Indians to qualify themselves for technical services; and with this end in view, the Railway Board was considering the question of providing for "passed" students of the engineering colleges, practical training in civil engineering on railways, and in mechanical engineering in the railway workshops.

Electric Vehicles at Hackney.—The money-saving qualities of electric vehicles employed in the collection of house refuse are again exemplified in a recent report of the Hackney borough surveyor. The report deals with the working of four of these vehicles for fourteen weeks ended January 21st, 1922. The total cost of collecting 1,787 tons, including capital charges, was £1,120. The cost of collection by contractors would have amounted to £1,324; thus a saving of £204 was effected. The present contract rate per ton, with wages at £4 per man, is 14s. 9½d.; this for 43,000 tons, which is the estimated quantity of refuse collected per annum in the whole of the borough, would be £31,847. The estimated running costs of 27 vehicles, which could replace the present system, would be £22,744. Adding capital charges, the total expenditure would amount to £28,444, showing an annual saving of £3,403, or 1s. 7d. per ton. The Finance Committee, in reporting on these figures, shows that even if the wages of contractors' men were reduced to 62s. per week, a saving of £2,228 could be effected yearly.

The Council proposes to expend £23,490 for vehicles, £8,100 for garage accommodation, and £5,450 for charging plant, making a total of £37,040, in order to institute a system of refuse collection by electric vehicles. A further £6,000 is required for improving the methods of handling the refuse at the destructor.

THE "VISCO" AIR FILTER.

A very interesting and simple new air filter for use in connection with turbo-alternators, blowers, compressors and ventilating plant, has recently been introduced by The Visco Engineering Co., Ltd., of Westminster. It may be termed a dry air filter in contradistinction to the so-called wet air filters or air washers, and appears to fill a long-felt want, as if the claims made for it are substantiated they would appear to dispose of the disadvantages of some other types of filters

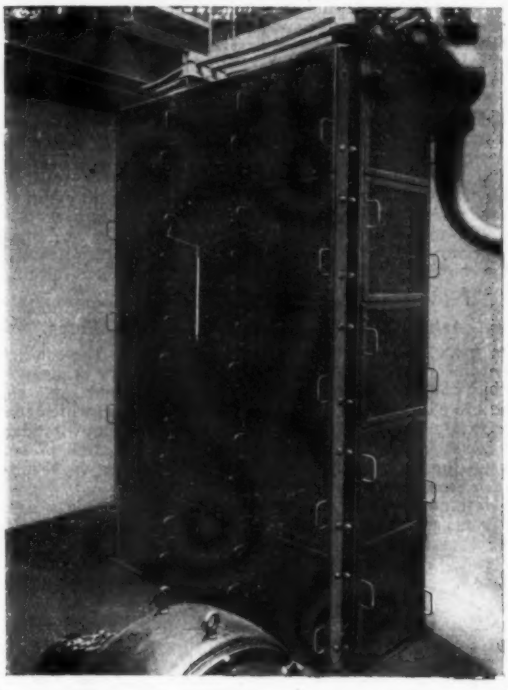


Fig. 1.—"Visco" Air Filter at Fulham Electricity Works.

The filtering medium consists of innumerable short rings of very thin coppered steel tubing of small diameter, coated with a very thin film of "Viscinol," a high-class mineral oil of special characteristics. It has a very high flash-point, and the temperature of the fire test is such as to render it practically non-evaporating and non-inflammable. This is very important, as it is essential that there should be no possibility of oil vapours being formed at any temperature likely to occur in practice. At the same time, the solidifying temperature is exceptionally low, so that the filter will not be affected by frost. The extreme viscosity prevents the oil from "running," and it is claimed that "Viscinol" will retain its filtering capacity for many months. Dust of all kinds has a great affinity for "Viscinol."

The cells, as shown in fig. 2, which contain the filtering ring, are made in standard sections about 20 in. sq. and 3 in. deep, and are stamped out of steel in one operation. The front is covered with expanded metal, and the back is provided with louvres. The cells are simply hooked on to a square steel frame. Any size or arrangement of filter can be built up from a number of these standard units into the shape desired.

The filtering rings lie quite irregularly in the cell and offer a very large surface to the air passing through, 1 cu. ft. of rings representing about 300 sq. ft. Due to their irregular position, the air is deflected from its straight course a great number of times without at the same time, even after months of use, meeting with any undue resistance. The latter varies between 4 mm. and 8 mm. W.G., according to the time the filter has been in use. Fig. 3 shows the front of the filter when clean, and after having been in operation for over 400 working hours. It is very interesting to note the thick covering of dust.

The cleaning operation, by either hot soda water or steam, is very simple, and becomes necessary only after many weeks' service. After cleaning, the cells are re-coated with "Viscinol" by simple immersion, and are then again ready for use. As a number of spare cells are supplied, the replacing of a dirty cell by a clean one is a matter of only a few seconds, and the service of the filter need never be interrupted. It can be completely cleaned whilst at work by replacing one cell at a time.

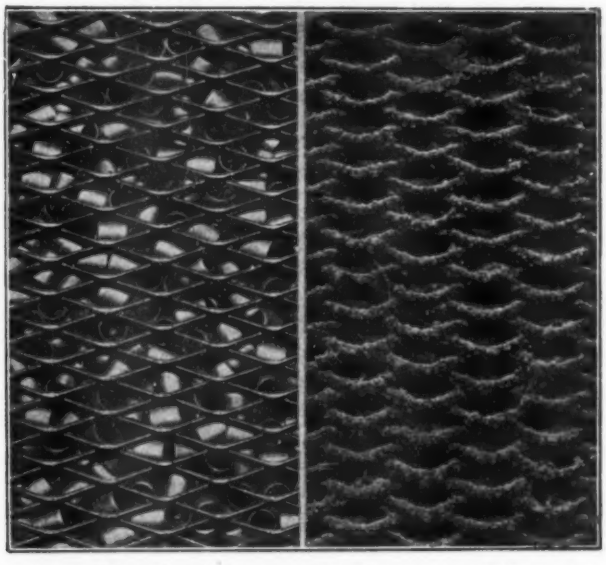


Fig. 3.—Front of Filter when Clean, and after 480 hours' use.

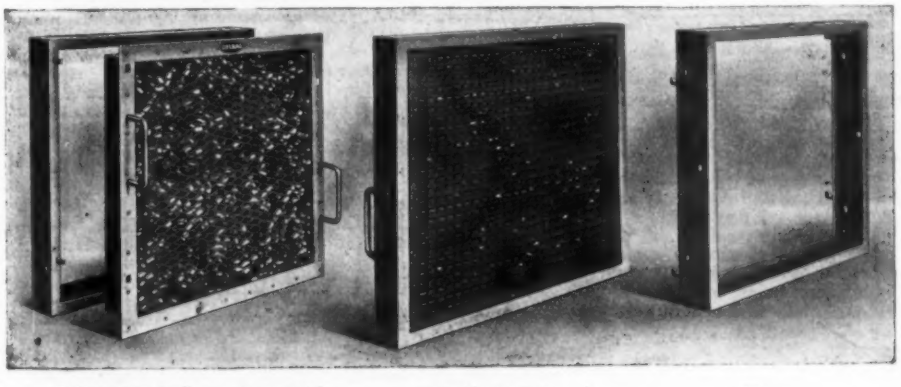
The great simplicity of the design, the absence of working parts, and absolute independence of atmospheric conditions, in conjunction with the small space occupied, high efficiency, and low initial cost, appear to render this filter a very attractive proposition. Fig. 1 gives a view of a filter with a capacity of 15,000 cub. ft. per minute, and clearly shows the extreme simplicity of the plant and the small space it occupies. Fire risk is eliminated, as the filter is made entirely of metal.

For small air compressors, air brakes, &c., special designs of small filters are supplied.

The company draws attention to the claims of the dry air filter as compared with the wet filter, and states that since 1916 over 2,000 sets, with a total capacity of over 20,000,000 cub. ft. of air per minute, have been supplied. They are used by, amongst other electrical firms, the following:—

Fulham Borough Council	15,000 cub. ft.
Brompton and Kensington E.S. Co....	9,000 cub. ft.
Kensington and Notting Hill E.L. Co.	8,000 cub. ft.
Darlington Corporation	30,000 cub. ft.
Glasgow Corporation Tramways ...	45,000 cub. ft.
London and South-Western Railway	21,000 cub. ft.

and some even larger sizes have been supplied to users abroad.



Cell and frame, air inlet side. Back of Section. Frame.

Fig. 2.—Details of "Visco" Cell.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A New Type of Feeder and Network Box.

Feeder and network boxes (known as the new C.S.W. type) possessing a number of novel and excellent features, are now being made by Callender's Cable and Construction Co., Ltd., Hamilton House, Victoria Embankment, E.C.4. The fundamental improvements embodied in the design are:—The mounting of the fittings on metallic frames; and the provision of renewable and adjustable spring contacts for fuses or

Fig. 1.—Frame Construction of New C.S.W. Box, and Link Extractor.

links. An improved form of grip fuse or link extractor is also provided. Fig. 1 shows the construction of the frame. It will be seen that this is formed by steel rods with rigid end pieces provided with feet. The insulators are moulded with grooves which fit over the rods, enabling the insulator to be moved along to the required position. This form of construction gives the necessary rigidity and strength; provides a clear space on the underside of the grid for cables to be jointed in the box; permits ready assembling and jointing;

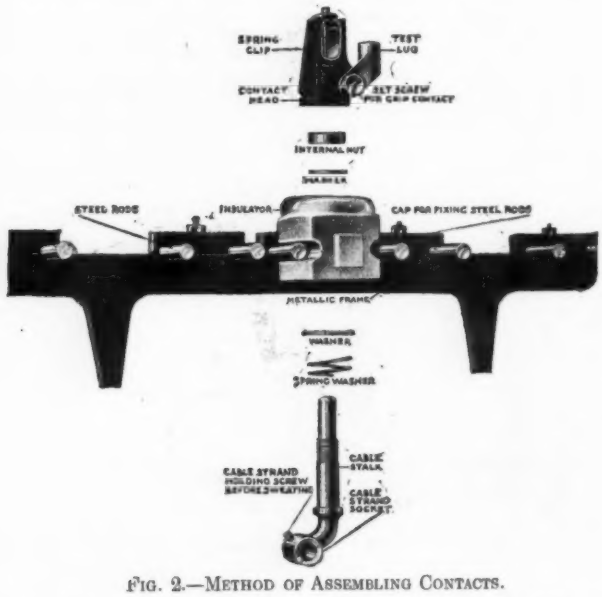


Fig. 2.—Method of Assembling Contacts.

and also enables the interior gear to be packed for transit separately, thus reducing breakages. The gear is so arranged that none but sweated joints are below the compound level.

The type of spring clip usually supplied with network boxes has been found to be either too flimsy, resulting in excessive heating, or else so constructed that renewal is difficult and expensive. A difficulty in cleaning contact surfaces has also been met with. In the Callender-Watson spring clip these objections are removed. The chief advantages of the contact are:—Easily-removable springs; adjustable pressure on contact surfaces; the spring, when removed, leaves a wide space between contact jaws, facilitating cleaning; the spring itself is not relied upon to carry any current; the spring is in compression, minimising fatigue in material; and there is no overheating. These spring clips form part of a loose contact head which is connected to the cable or bus-bar stalks by a grip contact, which introduces a minimum electrical resistance. The spring contact is shown in fig. 2. In the new fuse extractor a definite grip on the fuse-holders or "dollheads" is obtained. The extractor, which is seen in fig. 1, is made of "Kalanite," and consists of a two-part handle, one half being made to slide over the other. When the sliding part is raised by means of the finger, two recesses in the other half are disclosed, into which the dollheads fit. When the sliding portion is lowered, these recesses, with the dollheads inside, are covered, the dollheads being secured within the handle. When enclosed fuses are preferred, they can be supplied. For bonding the boxes are fitted with an attachment consisting of shallow iron pockets split on the centre line and embracing the lead sheath and armour of the cable. These pockets are filled with molten lead, which effectively bonds the lead sheath and armour of the cable to a copper bonding strand attached to the box by a clamp. This makes an efficient electrical bond and obviates the use of armour clamps.

"Artic" Pressure-contact Self-aligning Fuses.

The weakest points about replaceable fuses are the contacts; unless the current flowing is very small, there is always a possibility of an imperfect contact being made at some time in the life of the device, with consequent heating, which tends to aggravate the trouble. The British Engineering Standards Association attaches as much importance to the pressure between the surfaces in contact as to their area in securing freedom from heating.

In designing the "Artic" fuse, the makers made a departure from common practice by substituting for the usual spring clips an arrangement calculated to ensure both a large

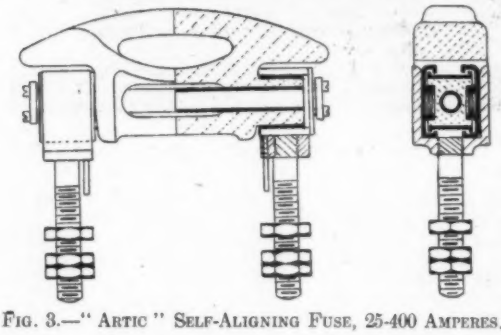


Fig. 3.—"Artic" Self-Aligning Fuse, 25-400 Amperes.

area of contact surfaces and a definite strong pressure between them under all circumstances. With these aims in view, they adopted rigid terminal clips and freely-moving contact plates on the fuses, forced outwards by strong springs; these plates are self-aligning in all directions, so that the fuse can be rocked about without affecting the efficiency of the contacts. There

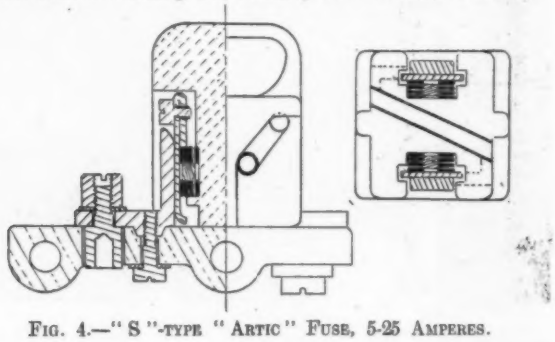


Fig. 4.—"S"-type "Artic" Fuse, 5-25 Amperes.

is a separate spring, of coppered steel, for each plate, arranged in a recess in the porcelain, as shown in the section, fig. 3; it will be seen that when the fuse is removed from the clips the plates are retained in position by small channel plates. The parts are so designed that they are easily assembled, yet they cannot come off, although in a 100-ampere fuse there are 12 metal parts (in addition to screws and washers) not one of which is attached to the porcelain. In the smaller fuse (5 to 25 amperes), fig. 4, the contact plates are arranged in a different manner but on the same principle, and cannot be

displaced without the use of a tool. The latter fuse is provided with a zig-zag path for the fuse wire approximating to a spiral of two convolutions, so that the current produces a magnetic blow-out at the middle of the wire, whilst the hole in which the fuse blows is at right angles to the live metal parts, and discharges the gases from the arc away from the contacts. This "S"-type fuse is very compact, though the break is 3¼ in. in length, occupying a space 1¼ in. square, and is mounted on a porcelain base, which can be threaded on rods; the bases are easily accessible for wiring by hinging outwards on the supporting rods, with a minimum of slack cable. In the larger fuses the path of the fuse wire is straight through, with ample provision for the escape of gases and for the circulation of air, and in both types the operator's hand is well protected from risk of burns or shock. A careful inspection of sample "Artic" fuses has convinced us that they constitute an important advance in fuse design, and will give a good account of themselves in practice. They are made by the Artic Fuse and Electrical Manufacturing Co., Ltd., of 68, South John Street, Liverpool.

A Lamp-shade Retaining Ring.

We illustrate in fig. 5 a new form of lamp-shade retaining ring, for which patent registration has been applied for by Mr. Hugh P. Bennett, 17, Tinto Road, Newlands, Glasgow. As will be seen, this is a ring with two inclined slots, the upper edges of which are provided with serrations, which

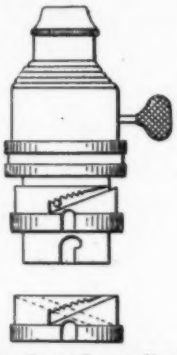


Fig. 5.—A New Lamp-Shade Retaining Ring.

engage with two diametrically-opposed pins on the lamp-holder. The principal advantages claimed for this form of ring are: there is no thread to strip; any thickness of shade can be employed; and the removal or replacing of the shade is facilitated. To save labour the inventor suggests the punching of projections on the holder in place of the pins.

PHYSICS IN ENGINEERING SCIENCE.

The newly-formed Institute of Physics has planned a series of lectures on the *rôle* which physics plays, or should play, in the various industries. The first of these lectures dealt with "Physics in Engineering Science," and it was delivered by Dr. Archibald Barr, of Glasgow, on April 26th, at the Institution of Civil Engineers. Mr. H. A. L. Fisher, the Minister for Education, gave a send-off to the series by presiding at this lecture, and the thanks of the Institute were offered to the chairman and the lecturer by Sir J. J. Thomson, the president.

Mr. Fisher, in his opening remarks, said that the appeal of the Institute was more particularly made to the business man, whom it reminded of the potentialities of wealth contained in the intelligent application of physical principles to industry. They built up their industrial prosperity in a period when they were well served by fortune with cheap coal and cheap labour, by a system of trial and error. They could not maintain their supremacy by this method in a competitive world. Science alone, he said, could enable them to maintain and extend their industrial conquests. The country was now waking up to the importance of physics, and while chemistry had the lead, physics was pursuing, as was evidenced by the increasing employment of physicists in industrial research and by the growing use of physical instruments and apparatus in numerous industries.

Dr. Barr began by contrasting the two different kinds of knowledge, that gained from science and that accumulated as a result of personal practical experience. One feature of the former was the length of time it often took before it was absorbed by the arts. This delay, however, obtained, and was bound to obtain, even in the case of inventions, for an industry was built up on plant—that was invested capital—and organised knowledge and skill, and these could not be scrapped at a moment's notice. If an efficient and economical method were discovered of producing electrical energy direct from coal it would probably be necessary to take political action to prevent its too precipitate application. Industry was an organism in delicate adjustment with its environment, and they must not destroy its balance by adding weight or by undermining its foundations till due preparations for the change had been made. In other words, "knowledge, like timber, should not be used till it is seasoned."

In a sense engineering science was really physics, for it was concerned with the properties of matter and the transformation of energy. But there was an important difference between the two in the complexity of the problems which the engineer had to solve. He could not reduce them to their simplest forms—deal with one variable at a time—like the physicist. A structure, like an animal, was an organism, and it had grown by gradual adaptation to its environment or conditions. The engineer had to devise a structure to meet requirements best in respect of all the functions that were to be performed. He could not proceed from first principles, as in solving a mathematical problem. His structure must be the result of a long process of evolution; his method largely the method of trial and error. Dr. Barr illustrated the considerations and conditions which defined the engineer's use of this method from the designing and building of a crane, and he showed how the calculation of the physicist had to be based on the experience of the engineer. In many respects the applications of physical laws in dealing with such a problem were in their infancy. It was only in very recent years that due attention had been given to the problem of finding the distribution of stress over various interfaces in a structural part that had any kind of discontinuity of form, and it was still more recently that a beginning had been made to give full consideration to the effect of more complex systems of stressing in producing failure in materials of construction. Only in the simplest cases could one at present calculate precisely the initial stresses produced in a structural part by a given system of external forces, or the strength of a given material to bear those stresses if they were at all complex. The use of a factor of safety of five or more was hardly a scientific operation, and here, therefore, was a fruitful field awaiting joint cultivation by the physicist and the engineer.

The lecturer claimed the name of "science" for the accumulated and co-ordinated experience of the engineer, even if sometimes it was science in Bacon's "Natural History Stage," and he went on to contrast the methods and processes by which progress was made in pure physics and in engineering practice. In pure science experiments were conducted under conditions that could be definitely specified, and the mathematical processes subsequently employed were founded upon idealised data. The engineer utilised these idealised results, but he must bring in also the disturbing agents and phenomena excluded by the physicist. Dr. Barr illustrated this process from the design and construction of scientific instruments. Thus, while theoretically redundancy of constraint should be avoided as involving unknowable reactions, other considerations made it imperative to depart from a construction preferable on the restricted view of the problem. Considerations of safety and convenience made it impossible to use for a crane the three feet hole-slot-and-plane method of support so effectively used by Kelvin in his scientific instruments. The three-support-single-slot-and-plane guidance that would serve for parts of an instrument that were to have relative motion in a straight line would not suit for a planing-machine table. The areas of sliding must be large to prevent abrasion and undue friction, and the table would require to be very heavily constructed to resist undue bending were it not so supported that the rigidity of the base of the machine was used to reinforce the rigidity of the moving table. It was practical considerations that led to the redundancy of constraint that had been criticised in the Forth Bridge, while the Quebec Bridge, where an attempt was made to have a more determinate system of stresses, did not even reach the stage of complete erection.

In conclusion, Dr. Barr characterised pure science from the standpoint of the engineer as the leaven and not the lump; an invaluable servant, but a bad master if it induced him to neglect the accumulated results of the labours of his predecessors. Much had yet to be done by physicists to solve even the most elementary problems the engineer had to face, but still the engineer must absorb all that chemists and physicists were able to teach him about the properties of materials and compound with it his large-scale experience of engineering practice. The union would react on the physicist, not only in giving him new problems to attack, but also in adding to their knowledge of the laws of the physical world.

The next lecture of the series will be delivered by Sir Alfred Ewing on July 4th, and it will deal with the physicist in engineering practice. Sir Charles Parsons will preside on that occasion.

The third lecture will deal with the physicist in electrical engineering, and will be delivered by Mr. Clifford C. Paterson on October 18th. Sir J. J. Thomson will be the chairman.

Fire.—Messrs. Baldwin's works at Landore (Swansea), formerly the National Shell Factory, was completely destroyed by fire on May 2nd. The damage amounts to many thousands of pounds, valuable plant and machinery having been destroyed.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

11,838. "Thermal cut-outs." O. P. Cramer. April 27th. (France, April 27th, 1921.)
12,071. "Motor-car, &c., lamps." T. B. Jones. April 29th.
12,072. "Insulating material." W. S. Smith. April 29th.
12,073. "Means for protecting electric apparatus from excess current." J. Bethenod. April 29th. (France, May 3rd, 1921.)
12,086. "Sparking plugs." A. W. Holmes and G. Lister. April 29th.
12,088. "Selecting switches." Western Electric Co., Ltd. (Western Electric Co., Inc.) April 29th.
12,108. "Thermionic vacuum tubes." C. Holt. May 1st.
12,122. "Devices for converting electrical energy into mechanical energy." C. R. Crofton. May 1st.
12,127. "Sparking plug." H. Swallow. May 1st.
12,144. Cycle lighting dynamo." G. S. Helliwell. May 1st.
12,145. "Jointing glass protective covers of electric lamps, &c., to fittings or casings." W. B. Shaw. May 1st.
12,146. "Attachment for telephones." M. C. Pierce. May 1st.
12,147. "Sound reproducers." C. M. Streete. May 1st.
12,152. "Electrical means for indicating, measuring, and/or recording small movements and vibrations of solid bodies." H. A. Thomas. May 1st.
12,153. "Telegraphic apparatus for transmitting messages, drawings, &c." P. M. Macintyre. May 1st.
12,154. "Thermostatic valves." W. P. Young. May 1st.
12,163. "Automatic keyboard and sound-recording and reproducing instruments." F. A. Andrews and C. Lamb. May 1st.
12,174. "Multipolar magneto-electric machine." H. Krebs and E. Wolff. May 1st.
12,175. "Drum-type controller." R. F. Baerlocher. May 1st.
12,176. "Electric resistance grids." R. F. Baerlocher. May 1st.
12,192. "Electric lamps." W. H. Eggington and H. Lucas. May 1st.
12,199. "Electric ciphering apparatus." A. Scherbius. May 1st. (Germany, May 23rd, 1921.)
12,229. "Transmission systems for electric drives." F. B. Holt and Metropolitan-Vickers Electrical Co., Ltd. May 1st.
12,236. "Means for preventing use of telephone without prepayment." J. D. K. Restler. May 1st.
12,270. "Electric resistances." S. H. Van Abbott, W. Ede, Radio Manufacturing Co., and E. W. Scammell. May 2nd.
12,272. "Metallic electric conduit systems, &c." H. S. Cowx. May 2nd.
12,309. "Electric advertising cash change plate." C. W. Moss. May 2nd.
12,317. "Electric meters." G. Sperti. May 2nd.
12,333. "Electric meters for recording telephone calls." W. Ramsay. May 2nd.
12,347. "Electric controllers for lighting circuits." Igranic Electric Co., Ltd. (Cutler Hammer Manufacturing Co.). May 2nd.
12,363. "Electric incandescent lamps." British Thomson-Houston Co., Ltd. (General Electric Co.). May 2nd.
12,364. "Electron discharge devices." British Thomson-Houston Co., Ltd. May 2nd. (United States, May 24th, 1921.)
12,369. "Driving mechanisms." Western Electric Co., Ltd. May 2nd.
12,370. "Illumination means for testing eggs." Ever Ready Co. (Great Britain), Ltd., A. H. Sheppard. May 2nd.
12,374. "Induction train-control systems." J. B. Regan. May 2nd.
12,375. "Induction train-control systems." J. B. Regan. May 2nd.
12,383. "Electro-mechanical control systems." Soc. Des Etablissements Gaumont. May 2nd. (France, May 28th, 1921.)
12,386. "Power plants." S. Klech. May 2nd.
12,389. "Gas-tight electric switches and lamps." F. W. Jolly and Watts, Fincham & Co., Ltd. May 2nd.
12,393. "Sparking plugs." K. E. L. Guinness. May 2nd.
12,404. "Inductance coil holders for wireless telegraphy, &c." A. W. Knight. May 3rd.
12,407. "Sparking plug." C. Lansdown and J. P. Sharpe. May 3rd.
12,411. "Tramcars and tramway tracks." J. R. Cahill. May 3rd.
12,419. "Wire cable couplings." C. Forrest, W. E. Gunthorpe, A. Sym, and R. Sym. May 3rd.
12,431. "Time-indicating device for use with telephones, &c." R. B. Clamp. May 3rd.
12,439. "Generators and switches of electric lighting sets for motor-vehicles, &c." W. J. Nicholas and P. J. W. Roberts. May 3rd.
12,455. "Dirigible head lights." F. Ottremba. May 3rd.
12,469. "Cable ends." H. Stanbridge. May 3rd.
12,473. "Electric light fittings." F. P. Fletcher. May 3rd.
12,491. "Magneto drives for motor-cars, &c." L. J. Pinch. May 3rd.
12,501. "Electric pocket lamps." L. Lavaillant and B. Stähelli. May 3rd. (France, November 14th, 1921.)
12,504. "Electric lamps." British Thomson-Houston Co., Ltd. (General Electric Co.). May 3rd.
12,508. "Electrically-propelled vehicles." J. E. Hamilton and Industrial Appliances, Ltd. May 3rd.
12,538. "Electric torches." Ever Ready Co. (Great Britain), Ltd., and F. S. Johnson. May 3rd.
12,553. "Alternating-current motor groups." Forges et Ateliers de Constructions Electriques de Jeumont. May 4th. (France, June 9th, 1921.)
12,554. "Loading coils." Forges et Ateliers de Constructions Electriques de Jeumont. May 4th. (France, March 27th.)
12,559. "Sparking plug." J. Nairn. May 4th.
12,590. "Electrodes for electric welding." J. D. Morrison. May 4th.
12,591. "Electric engine-starters or turning gear." K. A. B. Gilfillan. May 4th.
12,596. "Motor-car circuit interrupter." W. A. Brooks and W. G. Papworth. May 4th.
12,599 "Sparking plugs." L. S. Clarke and W. Wieland. May 4th.
12,607. "Electric lamp fittings." F. H. B. Rathbone. May 4th.
12,624. "Riveted joints for connecting electrical conductors to insulator." Scintilla. May 4th. (Switzerland, May 4th, 1921.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

29,646. "Relay transmitters." Sperry Gyroscope Co. October 20th, 1919. (152,674.)
31,935. "Electro-magnetic clocks." E. M. P. Favre-Bull. November 11th, 1920. (178,482.)
34,423. "Thermionic amplifiers used in transmitting speech or like currents of varying frequencies." Siemens & Halske Akt. Ges. December 5th, 1919. (154,925.)
35,510. "Insulation of electric cables." C. J. Beaver and E. A. Claremont. December 17th, 1920. (178,499.)

1921.

242. "Electric motor controllers." G. M. Shearer and F. H. Taylor. January 4th, 1921. (178,507.)
371. "Electric fuses." A. L. Eustice. September 3rd, 1919. (156,685.)
1,087. "Means for transmitting time signals over electric supply circuits." P. Trichard. July 13th, 1917. (157,213.)
1,325. "Wireless receiving systems." Ges. Für Drahtlose Telegraphie. December 2nd, 1919. (157,404.)
1,450. "Differential circuit couplings for modulating the amplitudes of high-frequency oscillations by means of sound oscillations." J. Massolle, H. Vogt, and Dr. J. Engl. March 3rd, 1919. (157,748.)
1,451. "Differential circuit couplings for varying the amplitude of high-frequency oscillations by means of low-frequency oscillations." J. Massolle, H. Vogt, and Dr. J. Engl. September 8th, 1920. (Addition to 157,748.) (168,846.)
1,514. "Electrical trip switches for railway, tramway, and like indicating mechanism." P. H. Waller. January 10th, 1921. (178,518.)
1,532. "Rheostats and grids therefor." W. H. Keller. January 6th, 1914. (157,803.)
1,649. "Arrangement for telephone installations with several trunk offices connected in series." Siemens & Halske Akt. Ges. November 18th, 1916. (157,938.)
1,870. "Systems of charging electric batteries." Crompton & Co., Ltd., W. F. Jones, and H. C. Waters. January 12th, 1921. (178,524.)
2,018. "Electric current regulator for automobile headlights." H. E. Wallace. January 13th, 1921. (178,530.)
2,299. "Insulators for electric lines." Soc. Le Basalte. January 23rd, 1920. (158,254.)
2,309. "Automatic and semi-automatic telephone exchange systems." W. Aitken. January 17th, 1921. (Cognate application, 3,165/21, 3,777/21, and 4,439/21.) (178,546.)
2,379. "Balancing ocean cable systems." Western Union Telegraph Co. January 28th, 1920. (158,202.)
2,565. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. January 19th, 1920. (158,276.)
2,684. "Signalling arrangement for preventing accidents on electrically-worked railroads where the electric locomotive is attended by one single man." F. Grünig. November 25th, 1920. (171,961.)
2,685. "Electric motor control." British Thomson-Houston Co., Ltd., and H. C. Hastings. January 20th, 1921. (178,571.)
2,717. "Electric discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. January 22nd, 1920. (158,509.)
2,718. "Electric discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. January 22nd, 1920. (158,510.)
2,719. "Induction apparatus, more particularly for electro-therapeutics." P. Bischofberger. December 14th, 1920. (173,919.)
2,798. "Electric telegraphy." B. Davies and Eastern Telegraph Co., Ltd. January 21st, 1921. (178,575.)
3,280. "Electric switching mechanism for electric motor control." British Thomson-Houston Co., Ltd. (General Electric Co.). January 26th, 1921. (178,585.)
3,802. "Manufacture of commutators of dynamo-electric machinery and the like." L. Neal. February 1st, 1921. (178,597.)
3,809. "Electric generating and supply systems." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). February 1st, 1921. (178,598.)
4,193. "Protective systems for turbo-electric and like generating sets." J. A. Kuyser and Metropolitan-Vickers Electrical Co., Ltd. February 4th, 1921. (178,604.)
4,382. "Transformers, reactance coils, and like electrical apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). February 7th, 1921. (178,609.)
4,474. "Locking devices for electric incandescent lamps." H. Francis. February 8th, 1921. (178,612.)
4,617. "Electric lamp discharge devices or the like." British Thomson-Houston Co., Ltd. (General Electric Co.). February 9th, 1921. (178,616.)
4,889. "Road vehicle electric lamps." A. J. Curnow and Howes and Burley, Ltd. February 11th, 1921. (178,623.)
4,950. "Junction boxes." A. P. Rutherford and A. N. Haddow. February 12th, 1921. (178,625.)
5,521. "Automatic electric couplings." A. V. Tomlinson (Westinghouse Air Brake Co.). February 17th, 1921. (178,640.)
5,557. "Securing wires, cables, and the like for ignition magnetos and the like." Villiers Engineering Co., Ltd., F. H. Farrer, and F. Pountney. February 18th, 1921. (178,641.)
6,130. "Electrical device for preventing the unauthorised use of motor road vehicles." J. Cæsar and A. Stevens. February 23rd, 1921. (178,650.)
6,540. "Safety electric signal for railways." L. Sanchez. February 26th, 1921. (178,656.)
7,021. "Electric lamp-holders." Compression Starter and Switchgear Co., Ltd., and R. Lomax. March 3rd, 1921. (178,661.)
7,036. "Electric cables for conveying energy." L. N. Reddie (Soc. Pirelli and Co.). March 3rd, 1921. (178,662.)
7,304. "Reversing contactors for electric circuits." A. West & Co., Ltd., and A. West. March 7th, 1921. (178,667.)
7,351. "Self-regulating dynamo-electric machines." W. Holt & Brolt, Ltd. March 8th, 1921. (178,668.)
8,822 "Radial-type commutators for dynamo-electric machines." G. A. Juhlin and Metropolitan-Vickers Electrical Co., Ltd. March 22nd, 1921. (178,685.)
9,604. "Sockets or bases of trolley poles for electrically-propelled vehicles." E. M. Munro. March 31st, 1921. (178,701.)
9,874. "Electric switch and fuse contacts." A. E. Wilson and Callender's Cable and Construction Co., Ltd. April 4th, 1921. (178,704.)
13,406. "Thermo-couple manometers." K. Kambayashi. May 11th, 1921. (178,737.)
14,065. "Means for ploughing with an electric tractor." P. Roulph. May 19th, 1921. (178,741.)
14,123. "Electrical vibrator for treating violins and like musical instruments, also applicable for other purposes." G. De Cairos-Rego. May 21st, 1920. (163,669.)
14,332. "Oil tanks for electrical apparatus." F. Gatta. May 23rd, 1921. (178,744.)
16,966. "Electric batteries." Svenska Ackumulator Aktiebolaget Jungner. June 21st, 1920. (165,102.)
17,597. "Electrical measuring and indicating instruments." R. H. Barbour and A. J. Martin. June 28th, 1921. (178,764.)
18,007. "Control of electric motors for electric cranes and the like." D. Adamson, W. Brooke, and E. Holme & Co., Ltd. July 2nd, 1921. (178,765.)
18,846. "Operating circuit and switch arrangements for electric car motors." F. B. Dehn (National Pneumatic Co.). July 12th, 1921. (178,769.)
19,540. "Rheostats and other electric circuit controllers." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). July 20th, 1921. (178,771.)
21,002. "Holders for electric incandescent lamps." J. W. Manley. August 8th. 1921. (178,773.)
21,283. "Electric torches or flashlights." F. S. Johnson and Ever Ready Co. (Great Britain), Ltd. August 10th, 1921. (178,774.)
26,002. "Devices for the sparkless disconnection of an inductive resistance." F. Krupp Akt. Ges. October 4th, 1920. (Addition to 158,873.) (169,721.)
27,231. "Automatic and semi-automatic telephone systems." W. Aitken. January 17th, 1921. (Divided application on 178,546.) (Cognate application, 25,563/21.) (178,783.)
27,787. "Means for operating signals or for producing other electrical effects between two bodies in relative movement." Ges. Für Drahtlose Telegraphie and H. Gewecke. October 22nd, 1920. (170,582.)
29,635. "Process and apparatus for starting three-phase induction electric motors." Siemens-Schuckertwerke Ges. December 30th, 1920. (173,480.)
35,045. "Overload switches for motors which are started by means of a starting resistance." F. Krupp Akt. Ges. January 3rd, 1921. (173,524.)

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2,395. "Electric relays." Metropolitan-Vickers Electrical Co., Ltd. February 26th, 1921. (176,332.)